THE PRINCIPLES

AND

PRACTICE OF PHOTOGRAPHY

FAMILIARLY EXPLAINED:

BEING A

MANUAL FOR BEGINNERS,

AND

REFERENCE BOOK FOR EXPERT PHOTOGRAPHERS.

COMPRISING

THE COLLODION PROCESS;

PRINTING AND TONING.
THE BEST DRY-PLATE PROCESSES.
LIGHT, LENSES, AND EXPOSURE.
HOW TO MAKE A GOOD GLASS ROOM.
FERROTYPES.
MAGIC LANTERN TRANSPARENCIES.
NITRATE BATH: ITS MANAGEMENT.
ALKALINE DEVELOPMENT.

BROMIDE EMULSION PROCESS;

AND

HOW TO MAKE AND DEVELOP GELATINE PLATES.

DEFECTS, FAILURES, AND REMEDIES,

ETC. ETC. ETC.

BY JABEZ HUGHES,

PHOTOGRAPHER TO THE QUEEN, H.R.H. THE PRINCE OF WALES, AND THE ROYAL FAMILY.

TWELFTH EDITION,

CAREFULLY REVISED, AND EDITED BY

J. WERGE.

LONDON: PUBLISHED BY SIMPKIN, MARSHALL & CO.,
4, STATIONERS' HALL COURT, E.C.,

AND

J. WERGE, 11A, BERNERS STREET, OXFORD STREET, W.

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PREFACE

TO

THE TWELFTH EDITION.

In this manual the Author has endeavoured to give simple and clear directions for producing photographs. He has adopted the familiar style, as admitting of the plainest and most homely language. The pupil has always been supposed to be at his elbow. The object has been to remove as many difficulties as possible from the beginner's path, and to render the commencement interesting. There has been no desire, however, to hide from the pupil the difficulties that he may meet with in practice; he is rather prepared for them, and instructed how to meet some and avoid others.

Part I. is confined to elementary manipulations and simple directions; many instructions and suggestions are more fully explained at a later part of the book, when it may be supposed that, with more extended experience, the pupil will be better able to appreciate them.

Part II. comprises information that implies a full knowledge of practical details. In this part the writer has compressed much of the matter that he has con-

tributed to photographic literature in the form of papers to various photographic societies, and to the journals devoted to the art. His constant object, whether addressing the tyro or the experienced photographer, is to beget a love for the art, and a desire for its improvement. The progress that has been made in photography is mainly due to the interchange of knowledge among those who practise the art, and the larger the circle becomes, the greater will be the security that this fascinating art will arrive at still higher degrees of advancement.

Part III. is devoted to dry-plate photography. This is a subject quite distinct, and should not be attempted until after the processes described in Parts I. and II. are completely mastered. The general principle of all the dry processes is distinctly stated, and the most useful of them are fully described.

Full particulars are also given of the Bromide of Silver processes, and an attempt has been made to describe, in popular language, not only the Alkaline method of development, but also the precise conditions under which it can be most beneficially employed.

London, May, 1880.

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ENGLISH WEIGHTS AND MEASURES.

APOTHECARIES' WEIGHT.

SOLID MEASURE.	FLUID MEASURE.
20 grains = 1 scruple.	60 minims = 1 drachm.
60 ,, = 1 drachm.	480 ,, = 8 ,, = 1 ounce.
480 ,, = 1 ounce.	160 drachms = 20 ounces = 1 pint.
12 ounces = 1 pound.	8 pints = 4 quarts = 1 gallon.

N.B.—It is important to remember that in all English photographic formulæ the solid and fluid measures of Apothecaries' Weight are used; but in buying and selling chemical articles the Avoirdupois Weight is employed.

AVOIRDUPOIS WEIGHT.	TROY WEIGHT.
27·343 grains = 1 dram.	24 grains = 1 pennyweight
437·5 ,, = 1 ounce.	20 dwts. = 1 ounce.
16 ounces = 1 pound.	12 ounces = 1 pound.

FRENCH WEIGHTS AND MEASURES.

1 gramme weighs nearly 15½ English grains (15.433).

1 ,, = 10 décigrammes = 100 centigrammes = 1,000 milligrammes.

1 kilogramme = 1,000 grammes = nearly 2¼ lbs. avoirdupois (2·247).

1 litre is equal to nearly 35¼ fluid ounces (35·2).

1 cubic centimetre is equal to nearly 17 minims (16·896).

1 millimetre measures in length 0·0393 inches.

1 centimetre ,, ,, 0·393 ,,

1 decimetre ,, ,, 3·937 ,,

1 metre ,, ,, 39·370 ,,

HOW TO LEARN PHOTOGRAPHY.

A FEW WORDS TO THE BEGINNER.

We are about to commence a course of familiar instruction in Photography. You are to be the pupil, and I am to be the teacher. It is your wish to learn how to take a picture by the action of light, and it is my purpose to instruct you; if you obey my advice and follow my directions you will soon acquire that knowledge. I wish you to be interested in each stage of the process of taking a photograph, so that you may be able to explain to any intelligent person the various steps as you proceed.

The first important fact I wish to impress on your mind is, that in taking a photograph you are executing a series of delicate chemical experiments. If these are carefully performed, a successful photograph will be produced; but if from carelessness or ignorance any portions are badly executed, the final result will be correspondingly unsuccessful.

You must therefore cultivate the habit of carefully observing all your operations; you must be exact in measuring and weighing your various chemicals, until you have experience enough to know the amount of variation that judgment will permit. You must also be very careful in using only clean vessels to hold the different solutions; the cleanliness

that is ordinarily considered sufficient will rarely do for chemistry.

The word Photography means drawing, engraving, or writing by Light.

You are, doubtless, aware that white light—light from the sun, for instance—is composed of several different colours, of which Yellow, Red, and Blue, are the most marked; it also possesses three distinct properties—Illuminating, Heating, and Chemical powers. These three powers are singularly connected with these three colours. The Illuminating property exists mainly in the Yellow rays—the Heating property in the Red — and the Chemical in the Blue or Violet rays.

With the illuminating power you are daily familiar; the July sun gives proof of its Heating power; and it is your present purpose to learn that all photography is based on its Chemical power.

For the full explanation of these facts I must refer you to Hunt's "Researches on Light."

Strictly speaking, then, it is not Light—the illuminating agency—that is the cause of Photographic action, but an active principle associated with it, and which is connected chiefly with the weakest illuminating rays, and with some that are even invisible. This Photographic power is termed Actinism.

The general term Photography embraces many processes, but the particular method I am going to teach you is called the "Collodion Process," because collodion plays an important part: this substance is a glutinous fluid formed by dissolving gun-cotton in a mixture of Ether and Alcohol.

The photographs taken by the collodion process may be

either Positives or Negatives. The meaning of these terms will be fully explained when I describe the manner of taking them.

APPARATUS AND CHEMICALS NECESSARY.

The first thing required is to obtain a set of Apparatus. Beginners too frequently get a cheap one, and are surrounded with unnecessary difficulties from this cause alone. There is no reason that the apparatus should be very expensive, but each article should be good of its kind. The quantity you will require will depend on the branch to which you devote yourself. Should you wish to be equally well furnished for producing Portraits and Landscapes, a full equipment will be necessary. The following comprises a complete set, equally adapted for all purposes, together with a list of Chemicals. Should there be more articles enumerated than you think you will require, you must consult with some photographic friend, or explain to the person from whom you make your purchase the description and size of pictures you wish to take, and you will be advised what articles to omit.

A "Rectilinear" Lens for landscape and architecture.
A well-made accordion-body Landscape Camera.
A light, strong, but portable Tripod Stand for ditto.
A travelling Glass Bath with water-tight top.
A portable Dark Tent, for working in the open air.
A Portrait Lens, fitted with Central Diaphragms.
A substantial square Mahogany Camera for in-door work.
A strong, well-made Camera Stand for in-door work.
A strong Iron Head-rest for standing figures.

Three Plate Boxes, to suit the sizes of the Camera.
Patent Plate-Glasses to fill the above.
A Corundum File.
A set of Scales and Weights, with Glass Pans.
1 Plate-cleaning Holder.
1 or more stout Oak Printing-frames.
1 Pneumatic Plate-holder for large plates.
2 or more Porcelain Dishes.
1 Ebonite Tray, to be used for "fixing" only.
1 large and one small Glass Funnel.
1 Ebonite Funnel, medium size.
1 each 20 oz., 5 oz., 2 oz., and 60 minim Graduated Glass Measure.
1 4-oz. tall Graduated Collodion Bottle.
1 Diamond for cutting glass plates.
1 Silver-bath Meter, for estimating the strength of silver solutions for painting.
A few Glass Stirring Rods.
Linen Cloths and clean Chamois Leather.
A few wide and narrow-mouthed Bottles.
A black velvet Focussing Cloth, about one yard square.
20 oz. Bromo-iodized Negative Collodion.
20 oz. Positive Collodion.
5 oz. Recrystallized Nitrate of Silver.
1 oz. Iodide of Potassium.
1 oz. Pyrogallic Acid.
1 oz. Citric Acid.
1 lb. Protosulphate of Iron.
4 oz. Nitrate of Potash.
1 oz. Nitrate of Baryta.
5 lb. Hyposulphite of Soda.

15 grs. Chloride of Gold.
4 oz. Kaolin.
4 oz. Cyanide of Potassium.
5 oz. Glacial Acetic Acid.
5 oz. Methylated Alcohol.
1 bottle Crystal Varnish.
1 ditto Spirit do.
4 oz. Acetate of Soda.
1 oz. Bicarbonate do.
1 bottle Black Varnish.
1 ditto Plate-cleaning Solution.
1 quire Albumenized Paper.
1 ditto white Blotting Paper.
1 book Litmus Paper.
1 packet of large round Filter Papers.
1 ditto small.

It is not necessary to get the chemicals in exactly the quantities stated, and for sizes below 8½ by 6½ in. smaller portions will do; yet it is not well to begin with too small a stock, as you will be apt to spill and waste a quantity at first; and if you reside in a country district you may experience a difficulty in obtaining articles sufficiently pure for your use. It is better to buy them of those persons who supply photographic materials, from whom you will obtain them cheaper and better than from local chemists and druggists.

Having selected your Apparatus and Chemicals, the next thing is to prepare a room in which to conduct your principal operations. This is technically called a dark room, though (except in a chemical sense) there is no reason that it should be very dark.

HOW TO PREPARE THE DARK ROOM.

Many persons imagine that any cupboard, or out-of-the-way corner, will do to prepare plates in: this is a mistake, and if you can select a room sufficiently large in which you can move about freely, it will be much better than being cooped up and crippled in your actions. Moreover, in warm weather, the fumes from the chemicals will be injurious to your health if the chamber be too small and ill-ventilated. All articles that can be spared should be removed from the room, and none allowed to remain that can be injured by chemicals being spilt upon them. It should be kept very clean, for dust and dirt are great enemies to good photography. Oilcloth or bare boards are best for the floor, not carpet. A convenient range of shelves should be made round the room, and some hooks provided for hanging cloths and towels on.

You will remember I explained that the Actinic force that accompanies Light resides mainly in the blue, and but little in the yellow and red rays; photographers ingeniously take advantage of this fact by illuminating their "dark" rooms with these non-photographic lights, and they thus see how to prepare their sensitive plates.

Every aperture and chink that admits white light must be carefully stopped up. If there be more windows than one, they should be blocked out, and the remaining one be covered with three folds of deep orange-coloured calico; or a hinged frame should be made to cover the window glazed with glass of a dark orange or a ruby red colour, so that you can have orange or white light in your room at will. Specially prepared coloured glass of this kind is

to be obtained from the Photographic dealers. If a window is not obtainable, a gas light, a lamp, or even a candle may be used, if a deep yellow glass be provided. An ordinary moderator lamp, with a yellow paper screen over it, makes a very fair light for the dark room. Persons usually make the room for preparing their plates too dark. This is a mistake; at least sufficient light should be admitted to enable you to see what you do, but it is important that this light be quite a dark orange yellow. Should you commit the error of admitting too much light, your pictures will be imperfect; you will find under the head of "Defects, Failures, and Remedies," on page 51, the proper method of proceeding in such a case.

Near the window or lamp, a strong shelf or table should be placed, on which to place the bottles you will require; and closely at hand you must have a supply of water. If you have the water laid on, with regular tap and sink, your arrangements will be perfect; failing this, you may have a cask or other vessel with a tap in it, filling it up with water as you need; or, on an emergency, use a jug and a pail to receive your slops. Have a towel and soap conveniently placed to wash your hands with.

Be sure and provide some effective means for ventilating this room. When you are not at work let the door and window be freely open, so as to encourage draughts of air through. In winter this room should be heated by a fire or stove, as the photographic chemicals never work properly at a low temperature. Do not use a gas stove for this purpose, unless it be one of the improved form, where the products of combustion are carried out of the room, for, next to a charcoal stove, an ordinary gas one is the most

poisonous and dangerous means that can be employed to warm an apartment, and especially a photographic dark room.

HOW TO BEGIN WORK.

Your apparatus being secured and your room prepared, you are now ready to make a commencement, and probably you will desire to make your first attempt in photography by taking a portrait.

But as you are a beginner, you should commence with the easiest thing, and to take a good portrait is one of the most difficult things in photography. The proper proceeding will be to set up a plaster cast, an engraving, a porcelain statuette, or some similar still-life object, and to practise upon it, being prepared for many failures arising from your ignorance and clumsiness, before you attempt portraiture. You should try picture after picture, noticing carefully the faults you commit in one, so as to avoid them in the next.

In this way, by patience, observation, and practice, you will speedily gain such experience as will make your new occupation a pleasure. Above all things, do not expect to produce good pictures all at once; and be not discouraged with failures, but try to understand why you fail.

In setting up an inanimate object to copy, the risks of failure are less than when you have a person to sit, for the object will not move nor alter its expression, nor make remarks if you do not succeed. But when brother Tom, or friend Harry, is called in, the case will be different; they will be full of fun and jokes, will most likely move at the critical moment, and say disparaging things when they find

the picture a failure. All this will confuse you, and cause you to omit things you ought to have done, and do abundance of things you ought not to have done, and dishearten you in your early progress.

You had better, therefore, set up a plaster cast bust—one painted stone-colour will be best—such as those of Shakspeare, which are so abundant, and, using this as a model, work frequently at it until you have sufficient mastery of your instrument and materials to produce, with moderate certainty, a passably good picture; then you may proceed to portraiture.

Place your object in a good light; a glass-house built for the purpose is the best; but this you may not at present be able to obtain. Should you have it in your power to erect a proper photographic studio, you will find on page 91 ample directions. Your early experiments may be made in a garden or a greenhouse, or a well-lighted apartment will suit, if you use a white screen—a sheet thrown over a clothes-horse will do—to reflect light upon the shaded side. A background may be formed by hanging some quiet drapery a little distance behind your object.

Place your plaster bust, or similar object, in a good ordinary light, and so arranged that a slight shade falls on one side, which will permit the modelling to be seen. Now get your portrait lens, and after wiping carefully the surfaces of the glasses with a clean silk handkerchief or chamois leather, screw it on to your portrait camera, and place them both on your heavy camera-stand opposite to your object. The ground glass of your camera should have the sizes of the glass plates marked on it in squares, corresponding to the position the glasses will hold when they

are placed in the plate-holder of your camera. Place your stand and camera so that the lens is opposite to about the centre of your plaster bust, and move the stand and camera backwards or forwards until the image of the object is of the size, and occupies the place on your ground-glass that you wish the image to do on the plate you are going to use, remarking that the nearer the camera is to the object, the larger the image will be, and *vice versâ*. Lay the black velvet focussing-cloth on the camera; put your head under the cloth, and you will then more clearly see the image on the ground-glass. Slide the inner body of the camera in or out until the image is seen quite distinctly, then fix the camera with the screw provided. While your head is still under the focussing cloth, pass your hand round to the lens, and move the rack backwards and forwards till you find the point at which the image is most distinct.* It is then said to be "in focus," or "sharp."

HOW TO PRODUCE GLASS POSITIVES.

The photographs that I shall first instruct you to produce are called "glass positives." At one time they were considerably in favour, but portraits on paper are now preferred. The production of a portrait on paper involves a double process, first making the *negative*, and then printing from it on to paper. Glass positives are the easiest, the quickest, and the cheapest to produce of any kind of

* These instructions for adjusting the focus apply to the common camera. The best kind of camera is provided with an endless screw arrangement, or a rack and pinion, by which the adjustment is made more easily and perfectly by moving the camera instead of moving the

photograph. As the manipulations are so similar, the practice of producing them affords the shortest and surest introduction to the knowledge how to take *negatives;* and as the final result is so quickly seen they suit the enthusiastic ardour of the beginner.

The chemicals required for this process are—

Positive collodion.
Nitrate of silver solution.
Plate-cleaning do.
Developing do.
Fixing do.
Crystal varnish.
Black do.

The "positive collodion" you will purchase ready prepared. When required for use, pour carefully three or four ounces into the tall collodion bottle; and when you have done for the day, return what remains back into the stock-bottle, that it may settle. In this manner you can always use from a clear quantity, and avoid those spots and defects which arise from a turbid or unsettled collodion.

The nitrate of silver solution is one of the highest importance. To know how much solution to mix, fill your bath with water to within an inch of the top, and measure how much it holds. Suppose it to contain 25 fluid ounces;* as 35 grains of nitrate of silver to one fluid ounce of distilled

* It is important to notice that in all photographic formulæ, where ounces of fluid are named, *fluid* ounces are meant, and that the glass measures are graduated for the purpose. When solids are named, *Apothecaries* weight is meant. But the materials are sold to you by *Avoirdupois* weight; and as the ounce of the latter is not so heavy as that of the former, this fact must be carefully remembered, or disputes with shopkeepers, and errors in mixing your solutions, will arise. The Apothe-

water is the proper strength, 2 ounces of nitrate of silver will be required to form 25 fluid ounces of the necessary solution. Dissolve the silver in 4 ounces of distilled water or boiled rain-water, then add 4 grains of iodide of potassium to it, shake it well for a few minutes, and add 21 ounces more of distilled water.

The solution will now be a pale milky colour, and will require filtering. Should it not run through quite clear, it must be re-filtered. Add one drop of pure nitric acid to every ounce of nitrate solution, and then it will be ready for use.

DEVELOPING SOLUTION FOR POSITIVES.

Protosulphate of iron	150 grains
Nitrate of potash	100 ,,
Glacial acetic acid	½ ounce
Water...	10 ounces
Nitric acid	5 minims
Alcohol	½ ounce

Dissolve the crystals, and if the solution be not quite clear, filter it, then add the alcohol and acids. It will keep good until it is a deep brown colour, when it ought to be rejected.

FIXING SOLUTION FOR POSITIVES.

Cyanide of potassium	60 grains
Water	6 ounces

Dissolve, and it is ready for use.

caries ounce weighs 480 grains, and the ounce Avoirdupois but 437½ grains. It is better, therefore, in mixing nitrate of silver solutions, to estimate the quantity required in *grains*, remembering that the purchased ounce of nitrate of silver will never contain more than 437½.

Let each of these solutions be distinctly labelled, and cork the bottles when they are out of use. The fixing solution should be legibly marked "Poison," to prevent accidents. It should be particularly kept out of reach of children, being a most deadly poison, despite its rather attractive smell.

The crystal and black varnishes that will be required when we finish the picture you can purchase ready for use. When these solutions have been prepared your next business is to learn

HOW TO CLEAN THE GLASS.

The description of glass known as "Flatted Crown" is well suited for positives, but, before using, it requires carefully cleaning. The sharp edges should be first removed with a "corundum" file, or by drawing the sharp edge of one piece over the sharp edge of another; then lay the glass on a clean flat surface, or put it in a "plate-cleaning holder," and pour a few drops of the "plate-cleaning solution" in the middle. Rub it carefully over every part with a bit of clean soft rag: turn the glass over, and do the other side the same. Then polish each side with a clean cloth, and finish with a soft chamois leather kept expressly for this purpose. Now breathe on the glass; and if the breath deposits evenly, the plate is clean. If the plate, however, shows patches and marks, it must be re-cleaned. Let the edges be carefully wiped, and the plate is ready for use.

The following preparation makes a good plate-cleaning solution for glasses that require mechanical friction to make them clean:—Ordinary water 5 ozs., alcohol 5 ozs., iodide

of potassium 15 grains, iodine 3 grains. When dissolved add tripoli, prepared chalk, whiting, or rotten-stone, in sufficient quantity to make a creamy paste. This thin pasty solution is to be rubbed on the plates on both surfaces, and polished off as already described. This amount of cleaning will, generally, be sufficient for new glasses, but when they have been used they require more labour. They must then be well washed under the tap, to get rid of all collodion and chemicals, and be wiped on cloths kept expressly for the purpose. Should the plates have been varnished, they must be soaked for some hours in a saturated solution of washing soda, till the varnish and film come freely off. The glasses must then be immersed for a few minutes in a solution composed of common nitric acid 2 ozs., water 10 ozs., and be well washed, and treated as already described. It is a good plan, when working, to have a dish of water at hand, and to place the spoilt pictures in it at once while they are wet, and at the end of the day to wash the glasses and put them away clean. By thus not allowing the films to dry on the glasses, they are much easier cleaned, and fewer failures will arise from dirty glasses.

Collodion is a good material for cleaning glasses when they are not very dirty. Pour a few drops on the glass, and well rub it with a clean cloth, and you will entirely remove all grease. A hint may thus be taken how to use up waste collodion.

The glass plate being cleaned—and it is a good plan to clean a dozen or so in advance—it is ready to receive the collodion. Remove the stopper from the bottle, and wipe from the lip any dust or dry film adhering; and, holding the plate horizontally by one corner with the thumb and

finger of the left hand, pour steadily into the middle of the plate as much collodion as will half cover it. Then gradually incline the plate so that the collodion flows to each upper corner, not allowing it quite to touch the thumb, nor to flow a second time to any part; then steadily pour back the excess from one of the lower corners into the bottle, and while the plate rests on the mouth of the bottle, move the plate backwards and forwards with a rocking motion to prevent the collodion setting in crapy lines. Perform this operation coolly and steadily, and try to avoid spilling any of the collodion. A little practice will make it easy. You must now shut your door and window, and see that only the orange light illuminates the room. When the collodion is *set*—usually in a few seconds—the plate is ready to be immersed in the nitrate of silver bath. To know how long to keep the plate before putting it into the bath is a point that you will learn by experience; but it depends on many circumstances, such as the nature of the collodion and the temperature; but this rule will guide you: if you put the plate in too soon, streaks and marks will be formed, commencing from where it first touched the silver solution; if you do not immerse it soon enough, the end of the plate that has become too dry will be insensitive, and will show a transparent mark. By noticing these points you can judge whether you have made an error in placing the collodionized plate too soon or too late into the nitrate of silver solution. The plate must remain in the bath in summer time about three minutes, and in winter from five to ten.

The collodion being set, now lift the dipper up, and place the back of your plate on it—it will adhere by capillary

attraction—and immerse plate and dipper into the bath solution with one steady dip, and continue to agitate the plate by moving it about in the bath for a few seconds. Take care it does not slip off the dipper. If there be the least hesitation or stoppage while the plate is being immersed, there will be a line marked across the plate.

While the paper is in the bath you must get ready your dark slide, and see that there are no dirty corners nor dust in it. Lift the plate up and down in the bath several times by means of the dipper, and the agitation of the solution will remove the oily-looking lines on the surface. Allow it to remain in the bath till all apparent greasiness is removed, and the film has become creamy-looking. Then take it off the dipper, and, handling it as carefully as possible—chiefly by the corner uncollodionized—let it drain for a few seconds on clean blotting-paper, and wipe the adhering solution off the back of the plate with a pad of blotting-paper; then lay it, collodion side downwards, into your dark slide, the silver wire corners supporting it by the four corners. Close up your dark slide, and your plate is ready for use.

You may now return to your plaster bust, and removing the ground-glass frame from the camera, insert the dark slide in the place. Cover the lens with the cap, raise the shutter of the dark slide, and gently remove the lens cap, so as not to shake the camera: thus the light will be admitted through the lens to the sensitive plate. Experience can alone determine the length of the "exposure." The brilliancy of the light, colour of object, kind of lens, nature of collodion, time of day, and even the period of the year, are all modifying circumstances.

Suppose you allow ten seconds. Count the time exactly,

and replace the cap on the lens. Next shut down the shutter of the slide, remove it from the camera, and take it into the dark room. Close the door, and, noticing that no white light is admitted, remove the plate carefully from the dark slide. The nitrate solution that has accumulated at the bottom of the plate, drain off with clean blotting-paper. Put about an ounce of developing solution into a clean measure glass, and holding the plate horizontally by the bare corner, collodion side upwards, pour steadily but quickly along the edge of the plate that was uppermost in the dark slide, sufficient to easily cover it; gently incline the plate to allow the developing solution to flow uniformly backwards and forwards. Watch the "coming out" or "development" of the image. The image will quickly appear; first, the parts most strongly lighted will show themselves, next the shaded portions, and when these are fully out, turn off the solution, and wash the plate well, by allowing the water to flow over it until the greasy lines disappear.

Lay the plate in a shallow dish kept for the purpose, and pour quickly over it sufficient of the fixing solution to cover it. Directly the yellow film of iodide of silver is dissolved, the plate must be lifted out and well washed. When the plate goes into the fixing solution, white light may freely be admitted. The fixing solution must be put back into its bottle, and may be used so long as it retains the power to dissolve the yellow film.

If the exposure be correct, and you have developed properly, you will now have a nice picture of your bust.*

* If the picture be not perfect, refer to the chapter on "Defects, Failures, and Remedies," page 60, for further instructions.

Your plate may be dried spontaneously or by heat. When dry, pour black varnish on the *glass* side, just as you did the collodion, and drain off at one corner, taking care it does not flow over to the face of the picture; or, better and easier, use a black varnish made expressly for the purpose, which is to be laid on with a brush, and which dries quickly, or may be assisted with heat. The collodion surface now requires varnishing, to protect it from atmospheric action. Remove carefully with a camel hair brush any dust or dirt on the picture, and pour crystal varnish over it as you did the collodion. Drain it, and when dry, your picture is finished and ready to be mounted.

You have now passed through the various operations, and it only requires practice and observation to make them familiar to you. Having obtained this practice, the bust may be removed, and a friend being placed in its stead, you may produce a portrait by applying the same manipulations. Let him sit in an easy, graceful position, and, if necessary, steady his head by the use of the head-rest. Let him look at some dark object, and allow him to wink his eyes freely during the sitting, but caution him to be quite steady in all other respects.

You have to put all this information into practice, and you will understand how to take *glass positives*.

HOW TO TAKE "FERROTYPES."

A FERROTYPE is a photograph produced in all respects by the same means and in the same manner as a glass positive, except that instead of using a glass plate to support the collodion film, a thin plate of black varnished iron is employed. The plate, being opaque, does not need a black

backing. They are not liable to break like glass, but in all other respects they are the same kind of photograph as a Glass Positive.

HOW TO TAKE NEGATIVES.

You must clearly understand the difference between a Negative and a Glass Positive. Every glass picture, to a certain extent, partakes of the nature of both: but a "glass positive" is a picture done at one operation, and complete in itself; whilst a negative is not so much a picture as the means of producing one.

Glass positives are examined by reflected light, negatives by transmitted light; the one you hold *down* to look *at*, the other you hold *up* to look *through*; the positives show natural objects as they are—lights for lights and darks for darks; the negatives just the reverse—faces, hands, and linen very dark, and black drapery quite clear. Hold a picture of each kind up to the light and look *through* them; the positive will appear thin and transparent, the negative dense and opaque. In other words, a negative is a glass picture produced by somewhat similar means to a positive, only that in the "development" a much thicker and denser deposit is formed.

The negative is to the photographer what the types are to the printer; and as the latter are arranged just the contrary of the impression that is taken from them, so must the photographer's negatives—his types—be the reverse of his prints. The analogy between the two processes is so considerable, that the production of paper pictures by the aid of negatives is always termed "printing."

It will be a great assistance to you if you can obtain from some photographer a negative that you can keep by

you, to compare with your own, until you have acquired experience to know how to judge for yourself.

The same apparatus serves for the production of negatives as positives, but some of the chemicals are different; those that you require are—

Bromo-iodized negative collodion.
Nitrate of silver bath solution.
Developing do.
Intensifying do.
Fixing do.
Spirit varnish.

The *bromo-iodized negative collodion* is rather different in its preparation to positive collodion, and is better adapted for giving dense pictures. It is often supplied as plain collodion and iodizing solution. When so supplied it is made ready for use by mixing three parts by measure of the plain collodion to one of the iodizing solution. It is better to add the iodizing solution to the collodion a few hours before using, to allow time for floating particles to subside.

Nitrate of Silver Bath Solution.—The same solution of nitrate of silver that you have used for positives will not do for negatives, but you must make another solution which you must keep exclusively for negatives.

I strongly recommend you to use a bath that will hold a larger quantity of this solution than is merely necessary to cover your plates. The greater the quantity of this solution that you have in use, the longer it will keep in good order, and the more satisfactorily it will work. Select, therefore, the largest vessel that convenience will permit,

and make up enough solution to fill it, according to the following directions :—

NEGATIVE NITRATE BATH.

Recrystallized nitrate of silver ...	1 oz. avoirdupois
Nitrate of baryta	40 grains
Iodide of potassium	1 grain
Distilled or boiled rain water ...	12 ounces
Glacial acetic acid	2 minims

Keep strictly to these proportions, whatever quantity of bath solution you determine to make up. Dissolve the proper proportion of nitrate of silver in one quarter of the quantity of the water required; in one ounce of the remaining water dissolve the iodide of potassium, and in the remaining quantity of water dissolve the nitrate of baryta. When these three solutions are formed, add that containing the iodide of potassium to the silver solution, and agitate well; finally add these united solutions to the one containing the nitrate of baryta.

It is a good plan to place the solution, without filtering, in a white glass bottle in open daylight, sunshine if possible, for as long a time as you can spare. When required for use, let it be filtered, and then add the glacial acetic acid. When the solution is out of use, let it be kept where it is constantly exposed to light.

DEVELOPING SOLUTION FOR NEGATIVES.

Protosulphate of iron	150 grains
Glacial acetic acid	$\frac{1}{2}$ ounce
Alcohol	$\frac{1}{2}$,,
Distilled water	10 ounces

This solution gradually acquires a sherry colour, but its quality remains equally good. It should be filtered before using.

FIXING SOLUTION FOR NEGATIVES.

Hyposulphite of soda	5 ounces
Water	5 ,,

This solution may be used until it loses its power of dissolving the yellow iodide out of the film. It soon becomes discoloured, but that is of no consequence.

"Patent Plate" is the best description of glass to use for negatives. It requires the same careful cleaning as for positives. As it is more difficult to produce clean negatives than positives, you had better accustom yourself to use a glass one size larger than you require your picture to be, so that the defects, which more frequently occur on the margin of the plate, may not spoil your picture.

Pour the collodion on the plate, sensitize, drain, and place it in the dark slide carefully, and according to the same directions as given for glass positives.

The same difficulty occurs with negatives, in giving any rule for the length of exposure in the camera, as in positives; the appearance of the plate during development is a useful guide, but negatives usually require three times as long exposure in the camera as positives. Be very careful, when your plate is in the dark slide, to keep it erect, and to handle it gently. Never knock the dark slide against anything, or the plate will be covered with abundance of spots from particles of dust and dirt falling on it.

You may experiment on your plaster bust for producing

your first negatives, as you did for your glass positives, or, if you have experience enough, you may attempt a portrait. During the exposure proceed the same as for a positive, making the requisite increased allowance of time for a negative. When in the dark room, take the plate out as carefully as before, and remove, with clean blotting-paper, the nitrate solution that has accumulated at the bottom; and, holding it by the corner, pour over it the developing solution, and in a few seconds the image will appear. After a little experience you will be able to judge, by the manner in which the image makes its appearance, whether you have given the proper exposure in the camera.

If it start out at once, directly the developer has flowed over the plate, the exposure has been too long; but if the image comes out slowly and reluctantly, and you have difficulty in making the deepest shades appear, it has not been exposed long enough.

The happy medium between these two is the correct time. When this has been given, the image makes its appearance steadily and gradually—first the high lights, next the light shades, and finally the deep shadows. Suppose it a portrait of a gentleman—the shirt-front, face, and hands are first seen; the light folds of the drapery next show themselves; and lastly, the details in the darkest parts. If it were a glass positive you were producing, you would have poured the developer off before these last were seen; but, being a negative, you must carry the development on until the whole of the details are clearly out, then pour the solution off the plate, and wash it well. By holding your plate up to the light and looking *through* it, you will see the image as a negative—the whites all dark, and dark portions

nearly transparent; and if the picture appears in proper harmony, making allowance for reversed effects, the lighter portions being nearly opaque, and the darker parts very clear—*but the whole picture full of gradations and half-tones, with scarcely any parts entirely opaque, and very few clear glass* —then the development is complete; if, however, the picture presents somewhat this appearance, but is deficient in opacity of deposit, or "density," it must be "intensified." To do this, pour over the plate as much as will comfortably cover it of the following—

NEGATIVE INTENSIFYING SOLUTION.

Pyrogallic acid	...	...	3 grains
Citric do.	...	...	1 grain
Glacial acetic do.	...	...	½ drachm
Distilled water	...	...	1 ounce

When this solution has thoroughly mixed with the water on the plate, pour it back into the measure-glass, and add a few drops of nitrate of silver solution to it (10 grains to the ounce of water), mix, and pour again over the plate; the image will speedily begin to intensify—that is, the silver will be deposited over the various parts where the light has acted. This intensifying must be continued until the parts of the negative most lighted have the requisite opacity.

This solution sometimes becomes turbid and muddy before the picture is dense enough. In such a case, pour it away, and renew with some fresh intensifying solution and silver, and proceed as before. This may be repeated many times, if needed, until the required effect is produced. Here is, perhaps, the most difficult thing you have to learn —to know how far to go, and when to stop; how to gain

intensity enough to produce a vigorous negative, and yet to avoid making it too dense, and losing half-tone. As a rule, beginners over-develop their positives, and under-develop their negatives.

But it is possible to intensify too much, and make the picture so dense that you cannot print through it. You must watch the kind of prints that different negatives produce, and when you find one that gives a brilliant yet soft image—for the real test of a negative is the kind of print it produces—study that negative well, observe the degree of opacity it has, and, keeping it as a standard, try and produce all others like it. In this way you can train and educate yourself to produce good negatives.

The development and intensifying being finished, wash the plate and lay it in the ebonite dish; pour the fixing solution over, and when the yellow iodide is dissolved out, give it a careful and copious washing; for if any of the hyposulphite of soda remain in the film, it will crystallize and spoil it.

Your picture now being washed, you may calmly examine it in ordinary daylight. If it appear as a moderately good but over-exposed positive, with a yellowish pearly tint, and, on looking through it, show abundance of half-tones, both in the opaque and transparent parts, you may consider you have a correctly-exposed and well-developed negative, and one from which you may anticipate brilliant prints.

If, however, the negative appear as a good positive, with brilliant blacks, but rather chalky whites, and, on looking through, if these whites are very dense without half-tone, and the blacks almost like bare glass, then your negative is defective, and will only produce a hard black and white

print; the fault being that it was not long enough exposed in the camera.

Should it, however, appear as a very much over-exposed positive, the whole plate having a grey film over it, obscuring the image, and on looking *through*, the details of the shadows are almost as intense as the white linen, and the whole picture is deficient in contrast, then it has been over-exposed.

The two instances I have pointed out are extreme ones; it is your object to avoid each; but of the two errors, under-exposure is the worst; by careful printing you may get a passable proof from an over-exposed negative, but no dexterity will avail with an under-exposed one, and, unfortunately, beginners' negatives, from their great desire to "work quick," have too frequently this latter fault.

I have now to call your attention to the last thing you have to do to complete your negative; viz., the varnishing.

HOW TO VARNISH THE NEGATIVE.

After the plate has been well washed and dried, it is ready to varnish. If only a few prints are wanted you may use crystal varnish. If, however, you value your negative, and purpose producing many prints from it, the crystal varnish will not give sufficient protection, and you must use a spirit varnish, which will produce a much harder surface. To use this spirit varnish, warm the dried negative before a fire uniformly all over nearly as hot as the back of the hand will bear, then pour the varnish on like collodion; let the varnish remain horizontally on the plate a few seconds that it may soak into the film, then drain off, and dry it with heat. The proper degree of heat to use will be acquired

by a little experience; if the plate be made too hot, the varnish will not flow uniformly over, but will run dry and into irregular streaks. If it be not hot enough, the surface will dry dull and dead. With the medium heat the film will dry with a hard, glassy surface. When cold your negative is complete, and is ready to be printed from.

HOW TO PRINT ON ALBUMENIZED AND PLAIN PAPER.

The remark has been made, that a *negative* is not so much a picture as the means of producing one; and your next proceeding is to use the negative to produce an impression on paper. This operation is called "printing," and the paper picture produced is termed a "print." There are two kinds of paper employed, plain and albumenized. The former yields a dull surface, like an engraving, and is chiefly used for pictures that have to be coloured; the latter has a glazed surface, and is the kind in general use for almost every kind of photography, as it gives a more brilliant picture, and yields finer definition.

It is scarcely possible to over-estimate the value of good printing. A good print is an adequate reward for much time and labour. Good printing depends on many things; and the first step towards obtaining a fine print is to get a good negative; this secured, it is surprising how many of your troubles will be removed.

The apparatus and materials necessary for printing are—

Printing-frames.
Porcelain dishes.
Horn or box-wood pincers.

American pegs.
Albumenized paper.
Plain salted do.
Nitrate of silver solution.
Litmus paper.
Kaolin.
Chloride of gold.
Acetate of soda.
Hyposulphite of soda.

Albumenized Paper.—This material is troublesome to prepare, and you can purchase it ready for use much better than you can make it for yourself. There are two principal kinds, known as *Rive* and *Saxe*. The former is a French paper, and has the highest glaze and finest surface; but the latter, a German one, is the most uniform in its general texture.

Plain Paper.—Plain paper requires preparing, or "salting," before being ready for use, or it may be purchased already salted. It is not a difficult thing to "salt" your own paper. Procure some sheets of plain Saxe paper, and immerse them for five minutes, removing air-bubbles, in the following solution:—

Chloride of ammonium	100 grains
Chloride of barium	100 ,,
Citrate of soda	20 ,,
Water	20 ounces

Hang the sheets up to dry, and they are ready for the next operation. This may be performed in ordinary daylight.

A very simple method of using paper as "plain"—that is, without glaze—is to employ the usual albumenized paper, but, instead of using the glazed or albumenized side, to sen-

sitize the back or plain side of the paper. No salting will be required, as sufficient is already in the paper with the albumen. Many samples of imperfect albumenized paper yield good plain prints, which are useless if the albumen surface is employed. The albumen helps to produce a much richer picture than is usually to be obtained on plain paper.

Nitrate of Silver Solution.—Whether you intend to print on plain or albumenized paper, you must make a fresh silver solution, as those used for positives or negatives are not adapted for printing; neither will the one you are about to make serve the former purposes; they must be kept for their separate uses. Measure how much fluid one of your porcelain dishes contains when filled half an inch high, and make so many ounces of plain nitrate of silver solution, 40 grains to the ounce. The crystals have simply to be dissolved, and the solution is ready to be tested. Place a piece of blue litmus paper in it, and, if it turn red, ammonia must be added until the blue colour returns. At each time of using the solution it must be tested, and it must never be used unless it allows the litmus paper to retain its blue colour. This solution may become discoloured by use, but if you adopt the plan of keeping some of the white powder called kaolin, an ounce or two, in the bottle in which you pour your solution after using, you will not be annoyed with your paper becoming darkened by the brown solution. Shake up the kaolin with the silver solution, and in subsiding the kaolin will carry down with it the colouring matter, leaving the silver solution clear. This solution rapidly loses its strength by being used—that is, the sheets of paper during the act of being sensi-

tized rob the solution of much of its silver. Therefore each day you must observe if the silver solution is sufficiently strong. Some albumenized papers require a stronger silver solution than others, but unless you are advised otherwise you will be quite safe in using one of 40 grains to the ounce. The "Argentometer," or silver bath tester, is a useful instrument to test the strength of your solution. Each time before using, immerse the Argentometer into it, and note the figure on the tube where the surface of the fluid touches, and it will indicate, with sufficient accuracy for practical purposes, the number of grains of nitrate of silver in each ounce of the solution. Thus if it stand at 30, 40, or 60, each ounce may be considered to contain so many grains of nitrate of silver. It is not sufficient that you originally mix your solution 40 grains to the ounce, but it must be continued so; and until you have experience you will scarcely believe how quickly the act of sensitizing the paper abstracts the silver. If you adhere to the use of this little instrument it will keep you right, but never forget that unless your silver solution is kept to its proper strength you cannot obtain brilliant and vigorous prints. I should mention here that the Argentometer, though very useful for estimating the strength of the printing silver bath, is not applicable to the negative bath.

Chloride of Gold.—This valuable substance is generally sold in bottles or tubes containing 15 grains. It is very deliquescent, and, unless hermetically sealed, can only be kept in solution. Break your tube, and dissolve the contents in a bottle containing five ounces of water, and label it accordingly.

Hyposulphite of Soda.—Dissolve two ounces in sixteen

ounces of water, and label the solution. Make a fresh quantity for every batch of prints.

HOW TO SENSITIZE THE PAPER.

As the prepared paper for printing is not nearly so sensitive to light as the sensitized positive and negative glass, there is not the same precaution necessary to perform the operations in so subdued a light; yet the presence of a strong white light is to be avoided. No more paper should be prepared than is required for the day's use, as it quickly spoils.

Fill your dish to the depth of not less than half an inch with the nitrate of silver solution. Cut your paper to convenient sizes suitable to your negatives, and lay it on its glazed or albumenized side downwards on the surface of the silver solution; if it is plain paper, lay it on the smoothest side. Hold the sheet by two opposite corners diagonally, so that the centre is the lowest, and allow this centre to rest first on the solution; then drop each corner. By this means the sheet can be easily laid on the solution without risk of the fluid getting on to the back, which would cause stains. When it has lain for about half a minute, lift up one corner with the pincers, and if there are any air-bubbles, remove them; replace the sheet, and allow it to remain two minutes on the solution, then lift it off, and draw the face of the paper over the edge of the dish, so as to cause the solution adhering to the surface to be wiped off and flow back into the dish. Then have ready a clean sheet of blotting-paper, and lay the wet sheet face downwards on the blotting-paper. This will still further

remove the silver solution, and will permit the sheet to dry with a uniformly sensitive surface. Thick blotting-paper should be used, and, if kept clean, will answer several times. Suspend the albumenized paper with an American peg to a line, in a closet, or other dark place, away from the light, where it can dry spontaneously. It is then ready for use.* Your paper ready, place your negative in the printing-frame, collodion side uppermost—be sure the glass is quite clean—and lay the paper on it, prepared surface downwards; put a few sheets of blotting-paper behind it; next put the hinged back in its place, and secure the whole tightly with the springs or other fastenings provided.

It is essential that the paper should be in very close contact with the negative to produce a "sharp" print, and you must observe that this pressure is uniform, to prevent breaking the negative.

Expose the frame to the full daylight, but not to sunshine, and allow it to remain until the paper is printed. How long this operation will take depends on the power of the light and the density of the negative. In summer, a very short period is sufficient, say from ten minutes to half an hour; and in winter, an hour, or even a whole day, may be required. To know how the print is proceeding, undo the fastenings *on one side of the frame only;* and by lifting up half of the hinged back, you can, without disturbing the position of the negative and paper, examine the latter, and

* It is right to mention that albumenized paper already sensitized can be purchased of the photographic dealers at as economical a price as the pupil can prepare it himself, and the paper so purchased will "keep" much longer than when prepared in the usual manner.

observe its progress. First the general outline is marked; then the deep shadows; next the lighter shades; and finally, the delicate half-tones. By these latter you must be guided. You must print till they are not only clearly out, but a few shades deeper than you would like them, because in the subsequent operations they will become lighter, and unless you make this allowance your print, when finished, will not be deep enough. A little experience will tell you how dark you should print. In printing portraits, you must judge entirely by the *head;* get out all the half-tones clear and distinct, so that the ultimate picture shall show the features nice and round, not buried in black shade from being over-printed, nor pale and flat from under-printing, but just such soft gradations as will make a pleasing likeness. When the proper depth is obtained, take it out of the printing-frame, and it is ready to be *toned* and *fixed.*

HOW TO TONE THE PRINTS.

If you are producing several prints, you may wait till they are all ready, keeping those first done in a drawer or other place secluded from light; they should be toned and fixed the same day they are printed, for although these operations may be deferred, the results are seldom so good. When ready, immerse them in a dish of clean water, removing air-bubbles, and move them about, that the water may get freely between; allow them to remain five minutes; pour the water away, and refill the dish, and again wash for another five minutes, moving them about as before; change the water a third time; this last time the water should only

be slightly milky ; if it is more than this, the prints must be further washed.

It is unfortunate that the print cannot be preserved with all the bloom and richness of colour that it shows when in the printing-frame. Very much of this beauty is destroyed in the act of "fixing" the photograph. To compensate for this loss, the print is passed through a process called "toning;" this consists in depositing a thin layer of gold on the silver image, whereby the print is made both more lasting and more beautiful. There are several toning solutions, but I recommend the following :—

TONING BATH.

Chloride of gold	...	...	... 7½ grains
Acetate of soda	...	...	... ½ ounce
Distilled water	...	...	... 40 ounces

The bath may be mixed in the above quantity, as it will keep for a considerable time. It should be prepared a day or two before being used. When required for use, pour enough in a dish to well cover the prints. Take the prints from the last washing water, and immerse them one at a time; keep them moving about and remove air-bubbles. Until you acquire experience, you had better not have more than three or four prints in at a time. They must be closely watched, for they speedily change from their reddish-brown to a purple tint; and if they have been printed deeply enough, the shades will pass to a purple-black, while the whites will assume a delicate rosy hue. Some little experience is required to know when to take them out, but you may be guided by the general appearance as seen by looking *through* them, holding them up to the

light. If they are purple when thus examined, they may be removed into a dish of clean water, to remain until they are all toned and ready to be fixed.

According to the depth to which you have printed, and the length of time they have been in the toning solution, so will the colour be. If you wish a rich chestnut brown, a very little toning will suffice; if you like a purple-brown, tone deeper; and if a dark purple-black, you must print and tone very deep. The colour of your prints will materially depend on your negatives. With a well-defined, soft, yet vigorous negative, you may produce any tone; but from weak or hard negatives you cannot produce good pictures. Prints kept too long in the toning solution become of a cold grey colour, and have a weak and flat appearance.

If you are attentive you will quickly learn how to get, with good negatives, almost any desirable tone by modifying the depth of printing and strength of toning. The time usually occupied in toning a print is from two to five minutes. The preceding instructions are mainly directed to highly albumenized prints; a little modification is required for plain paper proofs; they should be printed rather darker, as they have a greater tendency to bleach during toning, and the toning solution should be more dilute.

The prints must not be toned in broad daylight, nor in deep yellow light, for in the latter the shade of colour would not be seen. A weak shaded white light is the best. When the toning bath is new and strong, but few prints should be kept in at a time, and they must all be kept constantly turned over and moved about, so that they do not lie over each other, or get air-bubbles between them, and

thus get unequally toned. In cold weather it is better for the toning solution to be used warm; it will then tone much quicker. A useful plan is to fill a dish with hot water, and let the vessel holding the toning solution stand in it. The colour given by the gold must not only be on the surface, but must be seen when looked through as a transparency. Unless it is toned thus far, it will probably lose its rich colour in the next stage of "fixing." Most prints lose some of their tone in fixing, and allowance for it should therefore be made by carrying the toning a little further; but how much further is a matter for experience to determine, according to all circumstances of the moment. Some prints tone much more readily than others; some require to be carried further, according to the subject. When some are toned they may be taken out and placed in a dish of water, and fresh untoned ones may be put in until all are toned. They can then, unless too large a batch, be all fixed at one operation. The dish of water into which the toned prints are put to wait until they are fixed should have some common salt put into it, the quantity not important, so that it has a distinct taste. Unless this precaution be taken, the prints will go on toning; for when they are lifted out of the bath, they are saturated with toning solution. But this salt solution instantly arrests the toning action. The prints may safely be left here till the toning is completed for the day, and all are then ready for fixing.

When a glass positive or a negative is developed, there is seen to be a portion of the yellow iodide of silver remaining that has been unacted upon by light. This is removed by "fixing." In like manner, in forming a paper print,

there is left a portion of the chloride of silver that is unacted on by light, and which must be removed; if it were not, the print would turn dark all over when exposed to light. This operation is called "fixing" the print. There is this important difference, however, between the print and the negative: in the negative you can judge by the change of colour when all the unacted-on iodide of silver is removed; but in the print the unacted-on chloride of silver is of the same colour as the whites of the paper. You cannot, therefore, judge by any change of colour when your print is fixed.

HOW TO FIX THE PRINTS.

It is a good plan to keep special dishes for toning and fixing, especially the latter, as the hyposulphite spoils all gold and silver solutions. Pour your fixing solution into your ebonite or other dish specially reserved, and immerse your prints; immediately separate them individually, and keep moving them about, so that the solution may get freely to them all. The prints will quickly change, and lose some part of the beautiful hue they had in the gold solution, but this tint will be restored when they are finally finished.

The temperature of the fixing solution is a matter of consequence. When it is very cold, the hyposulphite materially loses its solvent action. Hyposulphite of soda in the act of dissolving deprives the water of much of its heat. Thus the solution of hyposulphite is found to be much colder than the water that was used to dissolve the crystals. It is better, therefore, in cold weather, to use warm water. The

feel of the solution to the hands will always be a good test for its temperature. It should always be such as to be agreeable to the hands. It need never be warmer, but it should not be used when it feels cold. The crystals should be entirely dissolved before the prints are immersed. As much solution should be made as to allow the prints to be moved freely about in it. Not too many prints should be put in at once, and when they are in they should be separated from each other as quickly as possible, to allow the hyposulphite to act. If the prints are allowed to adhere to each other, and air-bubbles to form between them, no end of trouble will be experienced, and the prints will probably be spoilt. All the prints should be got in as soon as possible after each other. Ten minutes will be sufficient time to allow them to remain in. They must be kept moving about and separated from each other the whole of the time. They may then be taken out and put in a large vessel of water, and the same process of separation repeated, so that the prints may as quickly as possible get rid of the hypo. When they are all separated and freely floating about, the water must be changed, and for the first half-hour the water must be renewed every few minutes, so as to remove the hyposulphite solution which the prints are saturated with. This is the stage at which the most effectual washing can be done. The prints should be kept in running water, and, if your circumstances will permit, should be kept in for six hours, and then dried. If you cannot give them the advantage of a running stream, change the water in which they are soaked every half-hour for the first three hours; then soak them all night, and next morning give them two or three changes, and let them

be dried. This well washing is the only security to prevent your prints from fading, for more are spoilt from neglect of this important but irksome part of the process than from any other cause.

HOW TO MOUNT THE PRINTS.

When dry, the prints may be very curly; but if ironed on the back with a clean, warm, flat iron, they will lie smooth, and then they may be cut and trimmed as taste dictates.

Hot thin glue may be used to mount them on cardboard; but starch, such as used for household purposes, and about the same consistency, is equally adapted. It should be used cold. To complete them, they should be sent to the hot-pressers, who, for a very small charge, will glaze them by rolling, which communicates a highly-finished appearance.

HOW TO BECOME A SUCCESSFUL PHOTOGRAPHER.

My worthy Pupil,—In the preceding instructions I have been as clear and as simple as I could, and have avoided explanations that, in your early progress, might embarrass you. That you may be successful is my ardent wish; yet as there is no royal road to photography, it is probable that you may be beset with troubles common to the practice of the art.

It may be a melancholy satisfaction to know that the cleverest practitioners are subject to them as well as the less skilful; the difference, however, being that the former,

by perseverance, overcome them, while the latter become beaten.

If there were no difficulties to be surmounted, there would be no credit in excellence, and one of the stimulants to advancement would be denied to the student of photography. The difficulties, however, that constantly arise, afford sufficient opportunity for the exercise of ingenuity, intelligence, and patience. It is enough to say, that if you meet with but few difficulties, deem yourself fortunate; and if you encounter many, be not discouraged, but strive to overcome them.

Generally speaking, to point out the origin of a defect is also to suggest a remedy. It is impossible to anticipate in what your difficulties will consist, for the experience of no two exactly agrees; but you must endeavour to *understand* the process, and to grasp the *spirit* of the directions. Above all things, resolve to be neat and clean in your manipulations, cool in your manner, and exercise an observing eye; by these means you will certainly escape from nine out of ten of the beginner's troubles.

Whether a person shall succeed or fail in photography depends very much on the spirit with which he commences. If he think the whole process a *mechanical* one—mainly a question of apparatus, baths, and developers—he has no pleasant future. When such a man gets into difficulty—which he soon does—he is apt to declare that his chemicals are bad, that his bath is out of order, that his camera is wrong; he is ready to blame anything and everything rather than his own defective manipulation, instead of calmly endeavouring to find out in what his trouble con-

sists. Possibly he may have mixed his plain collodion and iodizing solution in reversed proportions, or strengthened his nitrate bath out of the unlabelled hypo. bottle, or may have tried to develop with his cyanide. Such a man soon wears himself out, declares "it's no use trying, it's all chance;" and attributes the success of skilful men to the use of "secret dodges."

As a contrast, let us observe another kind of man, who, getting into trouble, thinks it probable that it is himself that may be wrong, and not the chemicals; and, instead of throwing them down the sink, perseveringly proceeds, finally discovering that the same chemicals that formerly gave him bad pictures now furnish good ones, the difference being only *in the mode of using them.* A man of this stamp, taking pride in his new acquisition, and not blind to his own deficiencies, reads the Photographic Journals, joins a Photographic Society if he can, compares notes with others who practise the art, keenly enjoys a visit to a Photographic Exhibition, and speedily becomes an intelligent and clever manipulator.

Although it is not possible to point out all the sources of failure you may experience, yet those most commonly met with will be described. When you are trying to discover a cause of failure it is important, in making changes of apparatus or chemicals, to change only one thing at a time, otherwise you may never know for certain the exact cause of your trouble. Some men never appear to care to know *why* they fail; they go on and on, always hoping for the best, and are rarely quite successful, for as soon as they are clear of one difficulty, another besets them.

ON THE EVIL OF DIRT.

There is no one thing in particular that I so strongly advise, as a preventive of failures in photography, as scrupulous cleanliness. Everything used should be clean. Clean negatives can only be obtained on clean glasses. Dirt causes smears, stains, streaks, comets, and fog. It is not only necessary to have the collodionized side of the glass clean, but also the other side, otherwise dirt is carried into the nitrate bath, and will put it out of order. Dirty dark slides cause dirty corners of negatives; dirty cameras permit dusty spots on the negative film. Dusty lenses give dim definition, and require longer exposure. Dirty developing glasses cause muddy precipitates; dirty filter papers contaminate the solutions that pass through them; and dirty bottles and measure glasses spoil the materials they contain. But the worst description of dirt is dirty hands. No matter how clean or pure things are, dirty hands can spoil everything. They are constantly ready to communicate their infection. Some men's hands are always dirty from heat and perspiration, and many are so from carelessness and indolence. Dirty sweaty hands are constant sources of photographic trouble, for they more or less contaminate everything they come in contact with.

Dirt is happily described as "matter in the wrong place;" dirt must, therefore, be hostile to successful photography, which consists in having matter in the right place. Although not scientifically correct, yet for practical purposes I may describe dirt as mechanical and chemical. By mechanical dirt I mean that which adheres to the surface of objects from atmospheric action, or from imperfect washing, or

dirty water. Chemical dirt consists in the remains left on glass, in bottles, and in measure glasses, of former materials employed, and which decompose and alter the nature of the fresh materials used afterwards.

Inferior photographers are often dirty and slovenly in all their manipulations and arrangements; some good operators are careless, but their success arises from their general ability, to which their slovenliness is a decided drawback. Most successful photographers are, however, in all essential particulars, scrupulously clean.

I dwell on this value of cleanliness because I know that by attention to it you will avoid many causes of failure. Besides, what is the use of my giving advice how to extricate yourself from your troubles if you carry at your finger ends the constant means of creating new ones?

The general instructions previously given have, in the main, been on the assumption that your manipulations were successfully accomplished; experience teaches, however, that failure may occur at every turn. To complete our task, then, we must devote attention to these failures—to photography under difficulties, photography out of sorts, photography ill, sick, knocked up, and confined to the hospital. Like a skilful physician, I must describe the various ailments, and the means of effecting a cure.

DEFECTS, FAILURES, AND REMEDIES.

"Humanum est errare.'

Many defects are more or less of a minor character, and though endeavours should be made to remove every imper-

fection, yet, and especially at the commencement, this may not be possible. There is one cause of failure that a beginner often encounters, that may hinder if it does not entirely stop his career. It is that terrible one known technically as "Fog." It is important at the outset to know how to conquer this difficulty. With this view the following ample directions are given.

ON THE CAUSES OF "FOG" AND HOW TO DISCOVER THEM.

"Fog" is a defect that arises from many causes; it consists of *a darkening of the film all over, directly the developing solution is applied.* It may occur only in a small degree, slightly obscuring the shadows of the picture, or it may exist to so great an extent as to prevent the appearance of the image. Sometimes deleterious vapours are the reason; as, the dark room being built over a stable, and filled with reeking vapour; the room being newly painted with a slow-drying paint; a leakage of gas; a bottle of ammonia with a badly fitting cork or stopper. A remedy for any of the above is simply to remove the cause.

In extremely warm weather the developing solution is much more energetic, and fogging may thus arise from this increased energy: remedy, dilute the developer with water one-half, or add double the quantity of acid. The following are, however, the most usual causes of fogging:—

Alkalinity of nitrate bath: remedy, addition of nitric or acetic acid till litmus paper is *slightly* reddened.

Extreme acidity of nitrate bath: remedy, addition of oxide of silver or ammonia until litmus paper is only slightly reddened.

Omission of acetic acid in the developer, or not sufficient acid introduced: remedy, add the acid, or increase the quantity.

Over-exposure in the camera: remedy, give shorter exposure, or insert a smaller sized diaphragm in the lens.

Diffused light in the dark room. If yellow calico be used, it has perhaps become bleached, and must be replenished; or additional folds must be used. Sometimes chinks of unsuspected white light are the cause; if so, they must be stopped up.

Diffused light in the camera or the dark slide, admitted through a joint giving way, or an old screw-hole, or the parts of the camera not fitting: remedy obvious.

Nitrate bath made with impure silver, or bad water: remedy, add a few drops of saturated solution of bicarbonate of soda until the bath solution remains turbid after shaking; then boil it or expose it to the sun for a few hours, and filter; then add acid until the image is clear in the shadows.

Newly mixed collodion will sometimes cause fogging; it then requires to be kept for a few days, when it may work clean; or it may be mixed with some older collodion, and may then be all right. Collodion should always have a sherry-colour to work without fog. When it is nearly or quite colourless, this golden colour can be communicated by the addition of an old sample that is of a deep brown colour; or if no such old collodion be at hand, a few drops of tincture of iodine may be added till the collodion acquires the colour; or a grain or so of iodine may be added direct to the collodion, in which it will rapidly dissolve. If none of these aids are sufficient, then the collodion must be rejected.

If the fog occurs at the same time that you make any

change—such as having a new camera, fresh nitrate of silver bath solution, a new quantity of developer, or another sample of collodion—you may be able at once to suspect and perhaps detect the cause of fog; for if some change occurs in the nature of the pictures which did not exist before, it is very probable that this fresh circumstance is directly connected with the changed character of the pictures. Therefore, whatever it is that has been newly introduced should be carefully examined, and very probably the cause of the fogging may be discovered. When, however, you have no such clue, you must adopt a systematic method for its discovery. The following is a certain means of finding out the cause:—

First, examine your dark room, by covering your yellow window with some material that entirely excludes *all light*. Crevices and cracks admitting white light may then be seen that before were unnoticed, and through some of these light may have shone on the glass during its preparation, and caused fog. If such be found they must be stopped up, and if these have been the causes your annoyance will be over.

If these be not the cause, you must next suspect the window, for though it may admit only yellow light, it may not be yellow enough. Yellow materials become bleached, and require renewing, especially yellow calico. To test your window—and it is very important that you be quite certain on this point—proceed as follows: collodionize a plate as usual, and immerse it in the bath; then cover up your yellow window entirely, or leave only the smallest possible chink, so that you can but just see what to do. Take your plate out of the bath, and put it in the dark slide. Now remove the temporary covering from the yellow window,

and draw up the shutter of the dark slide *half way*, to expose *one-half of the plate;* keep the plate to the light of the window for (say) five minutes, then replace the shutter, cover up the window with the temporary covering as before, so as to exclude the yellow light, and proceed to develop your plate. Keep the developing solution on about the usual time that is required to produce a picture, for you will not be able to see what is going on: then wash and fix it. Now restore the light and examine the plate, and it will present one of the three following appearances:—The half exposed to the window will be drab, and the half not exposed be quite clear and transparent; let us call this case A. Or it will have a drab deposit—in other words, fog—all over it; we will call this case B. Or the plate may be perfectly clear and transparent all over; let this be case C. As the plate *must* have one of these three appearances, by following up the investigation some definite information will certainly be obtained.

We shall examine each of these cases in succession. Case A shows that the yellow window is at fault, for the half of the plate exposed to it is fogged, but the other half is clear; therefore sufficient chemical light passes through the window to injure the plate. The yellow covering, if bleached, must be removed, or more coverings must be supplied, and a plate must be tried after each addition, until you have your window so yellow that a plate may be exposed five minutes without being fogged. Yellow glass sometimes allows light enough to pass through to fog the plate; such glass should be removed, and a better sample put in its place. I have seen a piece of yellow-brownish glass, though very dark in colour, that admitted actinic light almost as freely as white glass. This is rare, but in photography you must try all

things, and only hold fast to that which is good. If the window be discovered to be the cause of your trouble, it must be covered with fresh colico, tammy, silk, paper, glass, or other yellow material; or it may be painted yellow; but in some manner the light must pass through a yellow screen in such a way that, while you are permitted to see your manipulations, your plate must remain without fog. You must have no rest till this is accomplished. This done, your fogging trouble is over, and you may proceed to work in comfort; for Case A clearly showed the window was the cause of the fog.

It should be borne in mind, however, that the amount of protection that a yellow window gives to sensitive plates depends upon the quantity of light that falls upon the window. Plates may be fogged on a day of sunshine, and yet be perfect on a dull day. A yellow window, with a western aspect, may suit a morning light, and yet cause fog in the afternoon. When the window of the developing room is thus exposed to a variable light, it should be provided with an additional movable yellow curtain, to be used when a stronger light than usual falls on the window.

If the cause of fogging has thus been satisfactorily traced and cured, it will form an excellent lesson. But as there are other causes of fogging than an imperfect yellow window, let us examine the plate as shown in Case B.

Case B.—The plate darkens all over under the action of the developer, and you can distinguish no difference between the two halves: this shows that your window is quite right, because the half of the plate *not* exposed to the light from the window is as much fogged as the half that was exposed. This experiment also shows that it is nothing external to

the room that has caused the fog, for the plate has never been out of the room. It *must* therefore arise from something in the room, and if it be neither stray white light nor injurious fumes, it will lie between the bath, the collodion, and the developer. First, try the bath; test it with a strip of reddened litmus paper, and if it change to blue the bath is alkaline, and an alkaline bath is a common cause of fogging. Add acid, drop by drop, testing between each addition, until blue litmus paper is *very* slightly reddened. Again try a plate; the fogging will probably not be quite gone, but much reduced: add a little more acid until it entirely disappears.

Suppose, however, that the reddened litmus paper did not change colour, then test with blue litmus, and if it turn *very* red, carefully neutralize with oxide of silver, or ammonia, until only a slight acidity remains; then resume your trial to see if you have expelled your enemy, for excess of acid, especially nitric, will occasionally cause fog. Should the test-papers show that the bath is neither very acid nor alkaline, the probability is that the error is in the developer or the collodion.

Make up, carefully, a fresh developing solution, being particular not to omit the full proportion of acetic acid. You may even increase the quantity of acid, for some samples are weak, and you may happen to have one: the developing solution, unless it have its proper addition of acid, will always cause fog. If the new developing solution rid you of your difficulty, that will show that the cause of fog was in the developer; if, however, the fogging still remains, you must suspect your collodion. Some collodions cause fog, therefore get some fresh, and let it have a distinct colour—a

dark golden, for instance—for colourless collodions are more prone to fog than coloured ones. If you are not now relieved, you may assume that the nitrate bath is the defaulter, for it must be one of the three. Make up a new bath, and if you use good silver and clean water, you are almost certain to be out of your trouble.

In this way, by carefully and exhaustively examining one thing at a time, you will be certain to trace out the delinquent material. If you have decided that the nitrate bath, for instance, is the cause, then, if it be a new one, you have to find out whether the sample of nitrate of silver is pure, or whether the water is the cause. The latter is frequently an unsuspected source of trouble. Again, if it be found that the developer is at fault, supposing it to be correctly mixed, each of its components may be suspected and examined in turn—the iron, the water, the acetic acid, and the alcohol. Some samples of methylated alcohol often cause great annoyance by impurity.

To return to our examination: supposing that we have not yet discovered the cause of our fog; the conditions of Cases A or B not applying, let us examine Case C.

In case C the plate develops perfectly clean and transparent all over: this shows not only that the yellow window is all right, but that the chemicals are right also; in fact, that the origin of the fog must be *external* to the dark room; and, as nothing else but diffused light can now be the cause, we must seek to discover it. First examine the dark slide well; in some unsuspected manner it may admit light to the plate.

If your dark slide be found perfect, next examine your camera carefully. You may test it in this manner: pre-

pare a sensitive plate as usual, and place it in the camera, in its usual situation, as if you were going to take a picture; put the cap on the lens, draw up *halfway only* the shutter of the dark slide, but do not uncover the lens. Let the plate remain thus for a full minute, then develop and fix the plate. The plate will either be one-half fogged, or it will be quite clear all over. If half be fogged, it shows that the camera admits light in some other manner than through the lens, and thus the fog is caused. To know where the light is admitted, remove the ground-glass; and, excluding all light with the focussing cloth, put your head into the camera (the lens being still covered), and you will see the light streaming in. You may examine the interior of your camera in another manner. Place the dark slide in its place, with a plain glass plate in it, and draw up the shutter; remove the lens, and with the aid of the focussing cloth again examine the interior through the flange aperture. If any stray light be admitted, you will see it reflected from the face of the plate. It is necessary, when thus examining the interior of a camera, to wait for a few minutes, to allow the eye to get accustomed to the darkness, or you may deceive yourself, and think there is no light, from your momentary inability to perceive it. Supposing that you have found the light streaming through cracks, crevices, or holes, they must be stopped up; and the cause of your fog being discovered and removed, your trouble is over.

Should your plate, however, develop clear all over, it will show that the interior of the camera is perfect. Another cause of fog may arise from the lens itself. If a strong light fall on it, particularly sunshine, fog will certainly be

produced. A screen or shade should be provided, so that no light fall on the lens, except from the objects that are being delineated. Occasionally there is reflection from the sides of the lens tube, or the edges of the back lens. Dead-black varnish will be the remedy in these cases.

If you have not now traced out the difficulty, having run through your chemicals and apparatus, it is most probably caused by over-exposure. It is scarcely probable, however, that you could pursue this inquiry without already having a clue to the real cause. I have gone through this series of exhaustive experiments to show that by this method of inquiry you may succeed in tracing not only fog, but almost any other trouble, to its true source.

DEFECTS IN GLASS POSITIVES AND FERROTYPES.

The light parts are pale and misty, and what should be the dark parts are drab-colour. Over-exposure produces this effect; reduce the time in the camera, or place a smaller diaphragm in the lens, to cause it to work slower. If this treatment does not remove the mistiness, it may be produced by some of the causes of "fog," the remedies for which have been previously stated.

The blacks are very deep and brilliant, but deficient of detail, and the lights rather dark.—The exposure in camera has not been sufficient, or the developing solution has been poured off too soon.

The collodion film is full of honeycomb-like markings; the film has transparent, crapy, diagonal lines, especially where the deposit is greatest.—These defects arise from inferior collodion: procure some of better quality.

Opaque white marks and streaks at the end of the plate where

the collodion was poured off.—Keep the plate a longer time before you immerse it in the bath; if this does not prevent the markings, add plain *uniodized* collodion to the usual collodion in sufficient quantity to cause the markings to disappear.

Transparent insensitive mark at the opposite end to where the collodion was poured off.—The plate was kept too long out of the bath, and the upper part has become dry; the plate must be immersed sooner into the bath.

The picture, after washing off the cyanide solution, has blue stains.—The developing solution has not been sufficiently washed away before the fixing solution was used.

The shadows of the picture are clear, but the light parts are chalky, and deficient in half-tone.—The developing solution has been kept on too long.

The picture is brilliant when wet, but on drying becomes dull, the shadows being misty blue instead of bright black.—Bad collodion is the cause of this defect.

DEFECTS IN NEGATIVES.

The picture very intense where the light has acted most, and nearly transparent in the shadows.—The plate is under-exposed and over-developed.

The shadows have nearly as dense a deposit as the high lights.—The plate is over-exposed.

The image will not intensify under the action of the pyrogallic acid and silver solution.—There are many causes for this defect, and you must discriminate which is the most probable in your own case, and act accordingly. Bad collodion—inferior nitrate of silver—too much acid, especially nitric, in your nitrate bath—the exposure, too long or too short, in

the camera—the absence of sufficient nitrate-of-silver solution on the film or in the developing solution—cold and dark weather—deficiency of light—too small a stop used with long focus lens.

The film floats off or breaks away from the glass during development or subsequent washing.—Defect in the collodion; too much acid in the nitrate bath; plate immersed in bath too soon, or kept out too long. A complete remedy for this is to albumenize the plate before coating it with collodion.

Transparent spots.—Causes: particles suspended in the collodion; allow the collodion to settle, and do not use it to the bottom of the bottle. An ingenious Collodion Filter is sold at the shops for filtering collodion from insoluble particles. Transparent spots may also be caused by particles floating in the nitrate bath and adhering to the surface of the film while the plate is being sensitized; remedy, filter the bath. These spots may also be caused by the dark slide falling, or receiving a knock while the plate is in it, and particles of dirt falling from the interior of the dark slide on the film. Transparent as well as opaque spots arise from a dusty atmosphere and from grit that may fall from the walls and ceiling of the dark room: remedy, clean the walls and ceiling, but if their surfaces are in a loose gritty state it will be necessary to paper them.

Extremely fine transparent spots in enormous quantities, technically known as "pinholes," are caused by the nitrate bath becoming overcharged with iodide of silver: remedy, dilute the bath with an equal bulk of distilled water, which will cause a dense precipitate of iodide of silver; filter, and

add sufficient nitrate of silver crystals to restore the bath to its proper strength. It is better to add the bath solution slowly to the distilled water than to add the water to the bath solution, as a denser precipitate of the iodide of silver is thus produced. A more complete cure is effected by the addition of 4 grains of nitrate of baryta to each ounce of the silver solution, and if the bath is originally made up with this addition to it, as given on page 29, the annoyance will never occur.

Opaque spots. — Causes: developer not filtered; dust falling on the plate while being coated; dirt, and dried fragments of collodion from lip of collodion bottle; dust and dirt from dark slide, or from the other sources which cause transparent spots.

Streaky lines in the direction of the dip.—These are often caused, in a new bath, by deficiency of acid; in an old one, by the accumulation of ether and alcohol. Remedy: in the first case, add acid cautiously till the streaks disappear; in the second, mix with it an equal bulk of fresh 35-grain solution of nitrate of silver, or, better still, make up a new bath.

A frequent remedy for these streaks is to gently agitate the plate directly it is placed in the bath, and to keep it moving for twenty or thirty seconds afterwards.

There are many other causes for these "streaks in the direction of the dip;" they nearly always arise from either the collodion or the bath, and they often arise from a want of harmony between the two, for the same bath will give them with one collodion and not with another. Sometimes they are caused by the collodion containing too much iodizing solution for the strength of the bath. The remedy then

is to decrease the strength of the collodion by the addition to it of some plain uniodized collodion, or by adding five or ten grains of nitrate of silver to each ounce of the bath solution. Occasionally these streaks are due to the collodion being too horny and repellant; the remedy then is to add from two to five drops of water to each ounce of collodion. This makes the collodion more porous, and allows the ether and alcohol to mix more freely with the bath solution.

When a much-worked nitrate bath is allowed to stand unused for some hours it will frequently throw up a metallic scum, which, floating on the solution, causes streaks and other markings: remedy, wipe off the scum with blotting-paper, or change the bath for a fresh one.

Sharp horizontal lines across the plate.—These are caused by hesitation in dipping the plate into the bath.

Collodion film mottled and thick.—The collodion requires diluting with a little plain ether.

The collodion film, on drying, peels off the glass.—This is often due to inferior collodion; but the most usual cause is dirty glasses. It will arise also from pushing the development too much in cases of under-exposure; also from intensifying weak images by bichloride of mercury or other intensifiers.

When the film in drying is observed to split, which it generally does at the edges, a solution of gum water, weak albumen, thin gelatine, common beer, or any adhesive fluid, should be flowed over the plate. This in drying cements the film on to glass and prevents further splitting. It may happen that a film that has dried properly will, on commencing to heat it, prior to varnishing, begin to split or

peel; in that case pour the varnish on at once, even though the plate be cold, and continue the varnishing; the plate will dry with a dead surface, but if adroitly and quickly done, the film will be saved. A second varnishing with heat will restore the proper glazed surface. Sometimes, in drying a wet plate, the film will begin to split as it dries; in this desperate instance do not hesitate to pour the spirit varnish at once on the wet surface, and put the plate aside to dry spontaneously. When dry, the film thus preserved will present a curious appearance, covered with a white powder, the resin precipitated by the water from the spirit varnish. The plate may then be heated, and re-varnished with spirit varnish, when the surface will be restored to its right state, and betray little or no evidence of the unusual treatment that it has received, and the negative will be saved.

Markings like curtains and fringes.—When these do not occur from bad manipulation—and be careful not too hastily to decide—these faults may arise from the collodion or the bath, and the best remedy is to endeavour to obtain samples that will work without thus plaguing you. When a strong iron developer is used, it is important that you have the proper quantity of alcohol in it, as this causes the solution to flow easily and smoothly over the plate, and allows the developing solution readily to combine with the silver solution which is on the film. When the developer flows in irregular greasy lines, there are sure to be abundance of stains from this alone.

The formation of crystals and tree-like markings under the film when dry.—The hyposulphite solution not washed away enough. Sometimes this will show immediately;

at other times it may be days or weeks before being seen.

Irregular smears and stains.—Dirty glasses are the most usual cause; also lifting the plate out of the nitrate bath too soon; placing it in the dark slide before the greasy lines have disappeared; not draining sufficiently, and the solution accumulating at the bottom; from dirty and wet plate-holders in the dark slide; handling the plate with dirty hands; the developing solution not flowing uniformly; pouring the developer principally on one spot; plate immersed in bath too soon, or not soon enough; developing glass not clean.

DEFECTS IN PAPER PRINTS.

The paper does not print equally all over; has marbled or mottled spots.—The silver solution is too weak, or the paper has not been floated a sufficient time.

The print, when finished, has a disagreeable yellow tint, and, on looking through, yellowish-brown opaque patches are seen.—The print is not fixed; the hyposulphite is too weak, or has been in use too long, or the print has not been immersed long enough to dissolve the chloride of silver.

The whites and blacks are very brilliant, but a deficiency of detail in both.—The negative is at fault, it is under-exposed.

The prints are weak, and have a cold and slaty colour.—Under-printing and over-toning are the general causes. The hyposulphite solution may be too strong. Over-exposed negatives produce weak prints, deficient in proper contrast.

The prints are grey, and have a mealy appearance.—Over-

toning and defective paper; sensitizing solution too weak or too acid.

Red spots, streaks, or markings.—Defects in the paper, or the albumenizing, or both.

Prints will not readily tone, but remain of a brown, leathery hue.—Toning bath too alkaline; chloride of gold deficient in strength; the toning-bath exhausted; the paper kept too long before being printed on, or, after being printed, kept too long before toning.

Metallic smears, spots, stains, finger-marks, &c.—These defects nearly always arise from bad manipulation, such as handling the paper with dirty fingers, allowing solutions to splash, putting the paper on a dirty table, dust and dirt in the printing-frame, or on the pads used in the latter, or similar causes; or they may occur from bad paper.

GENERAL ADVICE TO THE PUPIL.

The proposed course of instruction in the collodion process is now completed; practice is only required to make you perfect, and to render the practice of the art a source of pleasure or profit.

From the progress you may be presumed to have made, there will be no need to continue the homely and familiar style in which the instruction has been hitherto conveyed, and the remainder of the information will be given in a more condensed form.

In Part III. you will find directions for the preparation of sensitive dry plates. These you should not attempt until you are quite competent to use wet

plates, as they are subject to most of the failures of the wet process, together with difficulties peculiar to themselves.

Part II. contains considerable information that will be useful to you as you acquire increased experience, and is more addressed to the expert photographer than to the mere learner.

Your attention is invited, however, to the following maxims and axioms, by attention to which you will save much valuable time and materials, and render the practice of the Art more interesting and profitable :—

MAXIMS AND AXIOMS.

Concentrate your attention on the production of a good clean negative; a professional printer may be employed to produce your prints.

Never expect the faults of your negative to be corrected in the printing; a good print can never be produced from a bad negative.

Take pride in cleaning the glasses well; stains and smears always indicate slovenliness and inattention.

Whenever you take a negative, take as good a one as you possibly can, even though it be a bad subject; almost anything looks well in a first-rate photograph; moreover, it is excellent practice.

Never be contented with a medium quality of picture if you can obtain a better one; "I daresay it will do" will not do at all in good photography.

Obtain the most perfect apparatus that your means afford, and take pride in keeping them clean and in good order.

Before using your lenses, wipe them with a soft chamois leather, and dust out the interior of your camera with a damp cloth.

Wipe your dark slide dry after each plate; the accumulation of nitrate of silver at the bottom corners of the dark slide stains the plate, rots the wood, and denotes the careless operator.

Frequently re-varnish the interior of your dark slide where the sensitive plate rests.

Carry your dark slide in a cloth when taking it from place to place (especially out of doors), and cover the top of the slide with it while the plate is being exposed.

Keep your camera exactly level when perpendicular objects are to be taken; nothing is so abominable as to see distorted representations. This especially applies to architecture; when buildings are made to appear falling forward, or leaning backward, or vertical lines are crooked and twisted, they always betray mismanagement of the camera.

Get all parts of the picture into focus if you can; if you cannot, then make the principal objects the sharpest—in a portrait, the eye; in a group, the central figures; in a landscape, the foreground, in preference to distant objects.

Keep your nitrate bath covered to exclude dirt and dust, and your bottles well corked and stoppered, as well as distinctly labelled.

Wash your developing-glass after each time of using.

Keep a separate vessel for every solution, and a separate bottle and funnel for each distinct purpose; let them all be distinctly labelled. Much time and trouble in cleaning

dishes and bottles will be saved, and no end of uncertainty removed.

Never open a bottle of collodion, ether, alcohol, or varnish, near a flame, or an explosion may take place.

Never allow the sun to shine on the lens when taking a picture.

Never attempt landscapes on windy or misty days.

Under-exposure is the unpardonable sin of photography, because it is irredeemable.

Aim at good pictures rather than quick ones.

There is more certainty in working a slow than a quick process.

Learn one process thoroughly, so as to be able to depend on it; then, and not till then, amuse and instruct yourself by practising others.

Do not attempt any dry-plate process until you are thoroughly master of the wet-plate process.

Use plenty of water everywhere; hypo left in your negatives will cause them to crack; hypo left in your prints will cause them to fade.

PART II.

HOW TO PRODUCE NEGATIVES IN THE MOST SUCCESSFUL MANNER.

The general directions that have been given in the earlier pages for taking wet collodion negatives, together with the ample instructions respecting "Defects, Failures, and Remedies," are amply sufficient for a beginner. Other and more full instructions are required when the elementary knowledge has been acquired. It would have been unwise to have entered into the full details in the first instance, as from inexperience the commencer could neither have understood nor appreciated them. These fuller details are now given. They are the result of careful observation and ripened experience, and if carefully followed will save the student much time, money, and anxiety.

The taking of a negative can be beneficially considered by treating of it in the four stages through which it passes:—The preparation of the collodionized glass; the sensitizing in the nitrate of silver bath; the exposure to the action of light to produce a latent image; the "development" of this latent image into a visible one.

If these operations are carefully performed they end in the production of that joy to a photographer's heart—a good negative. These four stages should really be regarded as one continuous one, the various parts of which should so dovetail and fit into each other as to produce an harmonious whole. Photographers often lose sight of this necessary unity; they speak of a collodion, a bath,

or a developer as being good or bad in itself: these things are good or bad only in relation to each other and to the mode in which they are used. This harmony of action forms the very key-stone of successful photography. If this be neglected, success will be a matter of chance; if it be attended to, failure will rarely occur.

Although each operation is more or less complete in itself, yet there is a certain margin in each whereby the shortcomings of one may be slightly compensated for in the other. This margin should, however, not be taken advantage of; but it should always be present to the mind, to be used as necessity suggests.

Allusion to this marginal action will be found running through the succeeding remarks on the four stages of the formation of the negative. These stages will be treated under the heads of the Collodion, the Nitrate Bath, the Exposure, and the Development.

ABOUT THE COLLODION.

It was the custom in the early collodion days to give, in manuals of this description, elaborate formulæ how to make pyroxyline, and from it to prepare with ether, alcohol, and the various iodides and bromides, many different kinds of photographic collodion. These directions are not necessary now; so many excellent collodions are supplied in commerce, that photographers in this country have almost entirely given up making their own collodion. In this they have shown their wisdom; it is no more to their purpose to make their collodion than their protosulphate of iron, pyrogallic acid, hyposulphite of soda, or other chemical

compound. So long as Mawson and Swan, Thomas, Huggon, and others continue to make such excellent collodions, there is no need for photographers to add to their troubles the preparation of this important material. Though all these collodions are good, yet each has a distinct character of its own, and as they are made so uniform, these characteristics remain constant. Each photographer can therefore select the maker's collodion that best suits the kind of negative that he prefers. Some persons think they discover an advantage in mixing the strong and vigorous nature of one maker's collodion with the more delicate kind of another. Most collodions give a thinner, more delicate, and quicker negative when new and freshly mixed than after being kept for a time; hence, for taking young children, animals, and other rapid work, advantage may be taken of this peculiarity. But, as a rule, a better negative—more harmonious and freer from spots and irregular markings—can be taken with a bromo-iodized collodion that has been mixed for a few days or even weeks. For landscapes and outdoor work generally, most collodions work best when they are a few months old, and for copying engravings and many other things a very old red collodion, that is not thin and decomposed, is the best kind to use. Where a plate has to be kept a long time after leaving the nitrate bath, as for copying old paintings or taking interiors requiring a long exposure, an old collodion is indispensable. Every photographer should therefore keep a reserve of old collodion for special uses. It is a good plan to have a stock bottle into which to put the bottoms and residues of collodion that require settling. This stock will at times be found to

be invaluable, either as an addition to a newly-mixed sample that works thin and weak, or to be used alone in especial cases. Collodion, like port wine, acquires a ripening influence by time which can be attained by no other means, especially if prepared with the salts of cadmium. A sensitized collodion film should not be transparent and blue, neither should it be creamy-opaque; both these conditions are the extremes; a happy mean between these two, showing a light transparency and a decided creamy appearance, indicates the best condition of the film to produce a soft yet vigorous negative. When the collodion produces a horny repellent film, which is shown by remaining greasy in the nitrate bath and refusing to readily blend with the developing solution, a few drops of distilled water may be added with advantage to each ounce. If too much water be added the film will be full of minute cracks like crape-lines. Water may therefore be added until this condition is nearly approached. If this does not remove the horniness of the film, or if the collodion will not permit the addition of water without becoming crapy, a small portion of carbonate of soda may be added so as to increase the porosity of the collodion. When the collodion becomes too thick it may be diluted with plain ether. The iodizing solutions usually contain sufficient free iodine to cause the collodion to have a distinct yellow colour, but some collodions lose this colour a few days after they have been mixed. In such cases tincture of iodine should be added until the sherry-colour permanently remains. A colourless collodion almost always causes a foggy negative, and it is better to add iodine to the collodion than to add acid to the bath. The ultimate effect of both is the same—to produce

the necessary amount of acidity to prevent fog; but by adding the iodine to the collodion the acidity is at once formed during sensitizing in the film itself. Too much iodine must not be added, or the negative will be slow, hard, thin, and of a metallic colour. If the collodion be too thin, yielding only a blue film when sensitized, one grain per ounce of pyroxyline may be added to increase its thickness and creaminess. If it yield negatives too violent and without half-tone, one grain per ounce of bromide of cadmium may be added, which will make it work softer. The reduction of intensity may also be produced by the addition of nitric acid to the bath, or by reducing the strength of the bath by the addition of water. If, on the other hand, too feeble an image be given, the acid in the bath may be neutralized, or the bath may be strengthened. Judgment may be exercised which method to adopt in these special cases.

HOW TO MANAGE THE NITRATE BATH.

The strength of the nitrate bath should be in proportion to the iodizing of the collodion. Commercial collodions have directions generally supplied with them as to the strength best suited. The range is between thirty and forty grains of nitrate of silver to the ounce of water. A thirty-five grain solution may always be taken as a safe proportion. Pure water, if it can be obtained, should always be used in making the bath solution. Good household water is often sufficiently pure to make the nitrate solution with, especially if it has been boiled and allowed to become cold. It is usually much better than rain water collected from house-tops, or the distilled water of the

chemists' shops. Many troubles connected with the working of the nitrate bath are distinctly due to impure water. As iodide of silver is slightly soluble in solution of nitrate of silver, the first few plates in a new bath will be imperfect unless this is provided for, as the nitrate solution will eat away from the plates the iodide of silver formed in the film. It is better, therefore, to add enough iodide of silver to saturate the solution in the first instance. After working, however, a new trouble of the opposite kind will arise from the solution being supersaturated with iodide; the plate on coming from the bath will be covered with a sand-like deposit, and on looking sideways at the plate, myriads of projecting points will be seen in relief on the surface. If the plate is used in this state these points will cause minute transparent spots in the negative, technically called "pinholes." If a plain solution of nitrate of silver be added, this excess of iodide will be absorbed, but will form again when the bath has been sufficiently worked. A complete remedy has been devised for this trouble by Mr. Henderson's addition of about four grains per ounce of nitrate of baryta to each ounce of the solution. After this addition these "pinholes" will never occur; it is better, therefore, to add the baryta when the solution is first made. Besides preventing "pinholes," the bath in all other respects works better for the addition of the baryta. There is one peculiarity, however, that must be noted—a slight bluish deposit is formed on the negative, showing chiefly in the shadows, which may at first be mistaken for fog. It is caused by a deposit of sulphate of baryta formed during development. It does no harm to the negative, as it entirely disappears in the varnishing. It is a curious fact

that this addition of baryta not only prevents the excess of iodide precipitating and forming pinholes, but it enables the bath to hold a greater quantity of iodide of silver in solution, and the full advantage of the baryta will not be obtained unless the bath is kept saturated with the iodide. Every time the bath is filtered, some iodide of silver should be placed in the filter paper to be dissolved as the solution passes through. It may be difficult, theoretically, to explain why the baryta should act thus beneficially, but continued experience places the fact beyond doubt.

Commercial nitrate of silver answers well enough for printing, but it rarely produces such good negatives as the recrystallized article; the fused nitrate, sold in one-ounce boxes, gives the best result of all. The common nitrate is apt to give a deposit on the negative of a grey metallic colour, while the other silvers give a brown colour of much deeper opacity. The better silvers also more readily yield that peculiar bloom which always indicates the highest class of negative.

Although there are some advantages in working with an entirely new bath, being slightly quicker and better adapted for long keeping of the plates (as in taking interiors, where the plate has to be exposed a long time), yet a bath that has been worked for some time generally yields superior negatives to an entirely new one. But a period will presently be reached when the ether, alcohol, and other products derived from sensitizing the plates, will so deteriorate the bath, that it will cease to give good negatives. It is then said to be "worn out." By a proper mode of working, and with nitrate of baryta in the solution, this condition need never be reached. In the first place, it is

advisable to have in use a very much greater quantity of nitrate solution than is necessary to merely cover the plate. This may be accomplished by using a vessel capable of holding a gallon or two gallons of silver solution. If, from day to day, or after each time of using, the vessel be kept filled from a fresh solution that has been tried and found to work well, such a bath will keep in order for an indefinite time, for the deteriorating influences that would spoil a small bath will be practically lost when distributed through so much solution thus constantly kept up.

If it be inconvenient to use so large a vessel, the same system may be adopted by keeping in use a large stock of solution, and every night, or after each time of using, the contents of the small vessel may be poured into the stock one and kept filled up. As a part of the system it will be necessary from time to time to evaporate the solution, to prevent the accumulation of ether and alcohol. This may be done by placing some of the solution, or the whole of it, in the oven, or on the hob, or over a lamp or Bunsen burner, or in the sunshine. It is a good thing to expose the solution to light, but the best of all is to give it a good boiling. By this means not only are the ether and alcohol evaporated, but injurious organic compounds are decomposed, and, by filtration, removed. Both light and heat have the properties of decomposing and purifying the bath; but to get the full effect in the shortest time the solution should first be neutralized by adding solution of carbonate of soda until turbidity, which cannot be removed by well shaking, is produced, or by the addition of oxide of silver, or solution of caustic potash, or ammonia, until litmus paper remains permanently blue.

There is also another satisfactory method of working by the use of *two* baths. In the first bath the plate is sensitized, say three-fourths of the necessary time, and then removed to the second bath for completion. The plate will then have little or none of the injurious influence of the products of sensitizing. After a time, when the first bath becomes very greasy and the second slightly so, the second bath may be used as the first one, and a fresh one used as the second. The displaced bath may then be neutralized, well boiled down, filtered, fresh water added to bring it to the required strength, when it will be ready, after acidifying, to do duty as well, or even better than when it was first made. If these methods be thought too troublesome, there is always the old plan to fall back upon of working a bath to death, running the risk, when the bath is apparently all right, of its suddenly breaking down at some inconvenient time, and being obliged to suspend work to make a new one. To provide for this emergency, which sooner or later is sure to come, there should always be a new bath made up ready to be put in use. This new bath should be in a neutral condition, and should be kept always in as strong a light as convenience will permit. The longer it is kept the greater certainty there will be that it will work well at once, after being made sufficiently acid; whereas a newly made up bath cannot work so well as the one that has been undergoing the ripening and purifying influences of light and time.

ABOUT LIGHT, LENSES, AND EXPOSURE.

If there be one thing more than another on which photographic success depends, it is the judicious use of light. It

is the most difficult part of the art to teach, because no absolute rules or exact formulæ can be laid down. If the idea be distinctly recognized, that as the light falls on an object so is it represented, the question of its "management" is very simple; for the lens may be regarded as an eye, and as capable of representing objects with the lights and shadows, only as it sees them. The photographer can, therefore, by the use of his own eye, judge of the effect that his lens will see, and he may take the photograph or not, according to the suitability of the light. In out-door photography this is of the greatest consequence, for some views are best illuminated early in the morning, others late in the afternoon, and some only about midday.

Before a photographer proceeds to take a picture he should settle in his own mind what sort of picture he intends it to be, and not wait until it "comes out" to see if it will "do." It is too late then. For instance, in portraiture, if he admire a broad, bold style, where the lights and shades are strongly marked and the whole picture very brilliant, let him arrange his light so that the sitter has the light falling on him in that manner, and then let him aim, by camera and chemicals, to accurately copy his model thus illuminated. If a soft and delicate picture—where half-tone abounds—be preferred, let the light be so arranged as to show these half-tones on the face of the sitter. Then, as before, let mechanical photography do the rest.

In a photographic glass-room the photographer should have the light entirely under his control; then by placing his sitter nearer to or farther from the window, and by the arrangement of curtains and blinds, he will be able to cause

the lights and shades to play on his sitter's face as he would like to see them in the finished photograph.

The lens is the obedient tool with which the photographer uses the light to draw with. The better the tool, the greater the capacity of fine and accurate drawing. Hence only the best lenses should be used. The lens serves two purposes—it defines the object that is to be delineated, and is the vehicle through which the light passes to form the latent image. Unfortunately, it cannot perform in the highest degree both of these valuable functions at the same time. When it is at its best for illumination, it is at its worst for definition, and as its power of defining is increased, its capacity for producing a latent image is correspondingly weakened. The first condition of a lens is that it should give a sharp image; the next is that the image should be soft and delicate. Fuzzy, out-of-focus definition is a miserable substitute for softness; extreme sharpness and softness go together, for the complete rendering of delicate half-tones is the very perfection of sharpness. A lens used with open aperture, though it gives the greatest volume of light, rarely gives satisfactory definition. Diaphragms must be used to improve definition. A lens with open aperture produces not only an ill-defined image, but also a more or less flat one; for with open aperture certain rays are admitted which, never coming to a focus, scatter diffused light, and extinguish the delicate modelling produced by those rays that are in focus. Open aperture should therefore be used as seldom as possible, and the smallest diaphragm that circumstances permit should be employed. The superior definition of the image will pay for the extra pains taken to produce it. Judgment will require to be

always exercised in making the compromise between these two opposite qualities—the light-giving and the defining powers of the lens. "Exposure" and "development" are so intimately associated that they should be regarded as one continuous operation—the impact of light commencing the formation of the image, and the developing action completing it.

RESPECTING DEVELOPMENT AND INTENSIFICATION.

The marvellous fact that light through the lens produces a latent image, and that the developer "takes up the wondrous tale," and makes it manifest, is, perhaps, the most remarkable thing in modern science; it is certainly the crowning excellence of photography. The utilization of this important fact gives exercise to the operator's greatest skill, for the exact adaptation of the "exposure" to the "development" calls forth his fullest ability. If these two halves of what may be regarded as one operation do not dovetail and fit each other, all the labour is lost. Hence the anxiety of the operator to observe the nature of the appearance of the image directly the developer is applied, to know whether the happy balance has been secured. There is, fortunately, a small margin by which he may increase or retard the developing action so as to adapt it to the exposure. This controlling power is, however, but limited, and it can be more easily decreased than increased. Hence the advisability always of permitting the light by lengthened exposure to produce a vigorous latent image, which shall not over-tax the bringing-out power of the developer.

After the application of the developer the manner in which the image makes its appearance indicates whether the correct exposure has been given; if the image come out slowly, steadily, and continuously — the most strongly lighted parts first, next the lesser illuminated parts, and finally the detail in the shadows—the plate has received the correct exposure, and the developer may be washed away. But if the image does not appear in this normal manner an error in the exposure has been made; the two halves of the operation do not fit. If the exposure has been too long, they, so to speak, overlap each other; if too short, they do not meet—the power of the developer being too weak to fill up the gap. In fact, there should be no recognised hard and fast line between development and exposure, and the developer should be used of such medium strength that on the instant it may be increased or decreased in power to suit the condition of the case. The safest rule is to determine that the exposure shall be so ample that the developer may be able with certainty to complete the work commenced by light; for if the exposure be short, the extremest power of the developer may not be able to continue the action commenced by light in the most weakly illuminated parts. Daily experience shows that if a vigorous latent image be produced, the silver eagerly and rapidly deposits itself on the illuminated parts, and nothing is produced upon the plate but a registration of the action of light. If, however, by reason of short exposure, the latent image be weak, it exhibits no such eager desire to appropriate to itself the silver which the developer precipitates. The deposit is formed, therefore, in unexpected parts, and stains and markings are the result. Hence the reason that im-

perfectly cleaned glasses are more betrayed on under-exposed than on fully-exposed plates, for when the developer is poured on the silver must go down somewhere.

A developer of from 15 to 20 grains of iron to an ounce is a medium strength, and is the best adapted for ordinary work. Any solution above 30 grains is a strong one, and below 10 grains is a weak one. A 60-grain solution is a good strength to have in reserve when the full power of the developer is required, and for exceptional use.

As the power of the light is irregular, it is impossible always to secure the right exposure to suit a medium developer; it is necessary, therefore, always to have handy a strong solution, either to be used by itself, or added to the usual developer, so as to increase its power, as the behaviour of the plate under development suggests.

There is no photographic manipulation where more neatness and dexterity are required than in pouring on the developer and getting it to flow over without letting any of the solution run off the plate. Sufficient quantity should be taken in a measure-glass, that should have, not a lip, but a broad curved edge, and the solution should be steadily poured on one side of the glass, the vessel being held very close to the film; the solution should not be allowed to fall on to the plate, neither should it be thrown on, but be allowed to flow out of the measure in one steady uninterrupted stream. While the one hand holds the plate with just that slight variation from the level to permit the developing solution to flow over it without any stoppage, the other hand should pour over the amount of developer necessary to comfortably cover the plate without letting any run over. This united action of both hands of pouring over and distributing the solution uniformly should be

done coolly, but quickly and firmly. If done hurriedly, or with indecision, too much or too little developer will be flowed on. If too much be poured on, some will flow over, carrying away with it a portion of the silver solution that is needed to develop and to intensify the latent image. If sufficient be not poured on, by the time the last corner is reached another part of the plate will be laid bare, and stains will result. Of the two errors it is better to flow on too much than too little.

Although, as a general rule, none of the developer should be lost when first flowing on the plate, yet circumstances will arise when this sound principle may be beneficially departed from. When a collodion is used that is horny and repellent, or when the nitrate bath is much charged with ether and alcohol, the plate, when examined before development, will be found to have the nitrate solution lying on it irregularly; it may be found collected in rivulets or in drops, or one end of the plate may be much drier than the other, especially if it be a large one; in these cases the state of the film will offer an obstruction to the uniform flow of the developer, and stains will occur if no more than the proper quantity of developer be used. Under such circumstances the iron solution must be used liberally, and it must be poured on with a sweeping force so as to compel it to overcome the repellent state of the film and the irregular deposition of the silver solution. The developer must go right over the plate with one broad wave, sweeping everything before it. A uniform clean development may thus be secured; recourse must be had to intensification for the silver solution thus lost. When a plate has been long kept out of the bath, as in taking interiors where a long exposure is necessary, or in any similar case, this method of

development must be adopted. It may also be advantageously employed when the subject photographed consists of violent contrasts, as a white house surrounded with dark foliage, marble statuary with dark background, or a very white dress and a dark face. These instances form the exceptions to an otherwise excellent rule.

The nature of the image formed is materially influenced by the strength of the developer. If a strong solution be used, the image will be developed in a rapid manner, and the deposit formed will be thin; stains and irregular markings are also apt to be produced by the action commencing before the developer and the solution on the plate have had time to properly mix. Weak solutions bring out the image slowly, and are conducive to clean working, as the developer and the nitrate of silver in and on the film have time to become blended before the image is developed. Weak solutions require longer exposure in the camera; hence, despite their other good qualities, they are not suited for occasions when a rapid exposure is necessary.

When the image by flashing out shows that it has been over-exposed, the plate should be immediately washed under the tap before even the details in the shadows are visible; fresh developing solution should then be poured over, and when well mixed with the water on the plate returned to the measure-glass, and with a few drops of silver solution added it should be returned to the plate; the development will then recommence, and the details in the shadows will come out, but with a lessened degree of intensity to that they would have done if the development had not been thus checked. The general flattening of the image and the want of contrast produced by over-exposure will thus be considerably corrected. The plate should then

be fixed, and after well washing be floated over with a weak solution of iodine in iodide of potassium, about a sherry-colour solution, and after washing again the intensification should be completed with pyrogallic and silver. If the first application of the pyro and silver does not produce sufficient intensity, the plate may receive another washing and soaking of the iodine solution, and, after washing, the intensification may be further proceeded with. An image thus originally very weak, may thus be built up by these alternate applications of the iodine water and pyro and silver. As such a plate may require considerable forcing to obtain the intensity, the iodine solution serves two excellent purposes—it gives to the silver already deposited an increased "bite," and capacity to receive fresh silver, and it preserves the shadows from a copper-coloured precipitate, which is very apt to be produced by this repeated forcing, unless this precaution is adopted. By these means an amount of vigour and contrast may be produced with an over-exposed plate that is not otherwise to be obtained.

If the image on the first development does not flash out all at once, as in the former case, but yet, when development is complete, a want of proper contrast is seen, no attempt at intensifying should be made until the plate is fixed and washed; the intensifying should then be completed, adopting the method already described. The intensifying *after* fixing causes the silver to be deposited, not uniformly over the image, but mainly on the more illuminated parts, thus creating a greater degree of contrast than would occur if the same intensifying had been done *before* fixing.

If, however, the image after the application of the developer shows only in the high lights, and the details of

the shadows are reluctant in appearing, some of the strong developer should immediately be flowed on, particularly to the portions where the details are not visible. This should be done quietly and cautiously, so as not to wash the silver from the parts where the details are absent, for the silver is needed to be precipitated there to form the image. Again and again fresh strong developer may be applied in these parts until all can be got out that is practicable. When the power of the developer is expended, it should be turned off, and, without washing, fresh developer applied, to which a few drops of silver are added. By care and coaxing, patience and close watching, and not using much silver, a lot of detail may thus be got out. All the developing and intensifying required must be done in this stage before the developer is finally washed off. This is the best way to treat an under-exposed negative.

The distinction between "development" and "intensification" should always be borne in mind in treating of the subject of development; if this difference be ignored—and in practice many operators do ignore it—the full capacity cannot be secured of adapting the forces of exposure and developing to secure their harmonious action. Development proper is the bringing out of the entire image in its completest details; when this is done development is completed. The amount of density that the image may have acquired during development is quite secondary. In many cases the developed image may be very thin and utterly worthless as a printing negative; in others it may have nearly or quite the required density, or the high lights may be too dense before the details are well marked in the shadows. These conditions depend on the state of the chemicals and the mode of conducting the development. The most perfect

working is to have the chemicals in such a state that the details in the darkest parts can be confidently brought out before the highest lights have quite acquired the necessary density. "Intensification" is the building up of the deposit of the developed image until the requisite density is produced to form a good printing negative. Weak images should be intensified before fixing, as that produces uniformity of density; strong images in which the contrasts are strongly marked should also have all their necessary intensity before fixing. Flat, over-exposed images, as also those that are deficient in contrast, should be intensified after fixing, and if considerable increase of contrast is required, they should be allowed to dry, the edges varnished a quarter of an inch in, to prevent the film rising, and intensification completed then. If the plates have been albumenized, this edge varnishing will not be needed.

ON REDUCING THE INTENSITY OF NEGATIVES.

When a negative is too dense, it may be reduced by the use of perchloride of iron. Make a stock solution of (say) 30 grains to the ounce of water. When a negative has been fixed and washed, take a few drops of this solution and dilute until it has a pale golden tint. Flow over the negative, or pour on to the particular part—face, shirt, hands, dress—where the intensity is wished to be reduced. The solution acts immediately, according to the strength, making the dense part rather duller in colour. Wash well, and then pour the ordinary fixing solution, hypo, or cyanide over the plate, and according to the action of the perchloride, so will be the reduction of the density.

The action is simple and easily understood. A layer of

the reduced metallic silver forming the image is converted into chloride of silver by the perchloride of iron, which layer of chloride is instantly dissolved off in the hypo or cyanide, thereby reducing the intensity. It requires careful using, or the greater part of the deposit will be changed into chloride of silver, and be soluble in the fixing bath. It is best to experiment on a waste plate before trying it on a valuable negative. If the negative is not enough reduced by the first application of the perchloride and fixing solutions, the action may be repeated until only the desired amount of deposit is left.

If the reduction has been carried too far the plate may be re-intensified by pyro and silver in the usual manner.

HOW TO INTENSIFY NEGATIVES AFTER THEY ARE VARNISHED.

When a negative has been varnished, its character is supposed to be beyond the reach of alteration or improvement. It is as well to know that a negative need not be given up as hopeless, even under these circumstances. To make "Negative Intensifying Varnish," add tincture of iodine—alcohol 1 ounce, iodine 10 grains—to any good negative spirit varnish, until of a very deep sherry colour. When a negative prints weak and without sufficient contrast, re-varnish with this varnish; pour on in the usual manner, allowing a few seconds for the yellow varnish to penetrate the film, and dry by heat as usual. The negative will be changed to a more non-actinic colour, and will produce a more brilliant impression on paper. It is well to keep two varieties of this yellow varnish: one of an ordinary sherry colour, for negatives that only want a little intensifying;

and another with a very deep port-wine colour, for negatives that are very weak. Used with care and judgment, these varnishes will be found very useful.

HOW TO CONSTRUCT A GOOD GLASS-ROOM.

To have a well-constructed glass-room is a matter of vital importance as well to the amateur as to the professional photographer, but especially to the latter. Such a room ought to permit the sitter to be properly and quickly lighted, so that good portraits can be taken with expedition. It should be adapted for working in dull weather as well as bright, and the sitter should be able to have either side of the face taken without turning the eyes to the light. The room should be well ventilated, so as not to be too warm in summer, but sufficiently so in winter; and no fumes of chemicals should be present. Many of these desirable conditions will depend on the size and aspect of the room.

During the last few years glass-rooms have been built in every variety of form; but after a fair trial, practical men are satisfied that an oblong room, with a ridge roof, is the best. Local necessities will often dictate the size, shape, and aspect of a room; when, however, the photographer can have control, the writer believes that a room built as he is about to describe will be found to be the most perfect that present knowledge can suggest. If circumstances permit, the room should be built on the ground floor. It should be oblong in form, the length running from east to west, so that one of the long sides should have a clear north aspect. Its length should not be less than 25 feet, and need not be more than 40 feet. The width may be 16 feet, but must not be less than 10 feet. Although called a "glass" room, it should be all built of substantial brick-

work, except the side facing the north and half of the roof on the same side; two-thirds of these should be of glass. The south side of the roof should be slated, and the whole building should, if possible, on that side be built against a wall much higher than itself, so as to screen it from the sun at midday. Buildings, trees, or other objects should protect the ends from the morning and afternoon sunshine. A room built in this manner will be lighted only from the north, and will have the most uniform and soft light that it is possible to obtain. If these natural advantages cannot be obtained, strong substantial screens should be erected on the roof to prevent the sun shining into the room. Undisturbed by sunshine, morning, noon, and afternoon, the light will be so steady and uniform that the photographer will be able to produce his negatives with almost absolute certainty.

Suppose a medium of the sizes referred to be adopted—say, 32 feet long by 12 feet wide—a handsome apartment will be formed, large enough to take a group, and to contain the apparatus and furniture of a well-appointed studio. The sides up to the eaves of the roof should not be more than 7 feet, and need not be so much; the height to the ridge should be in proportion, from 10 to 12 feet high. This will give a good slope to the roof, helping to keep the glass clean, and to prevent leakage, to which fault flatter roofs are very subject. The glass should not go to the ends of the room, but about 6 feet of each side should be bricked up, and the roof should be slated at each end about 6 feet also. If the room be 32 feet long, this will yield about 20 feet length of side and top light, all of which should have opaque blinds. As it is not advisable at any time to use more light than is necessary to illuminate the

sitter, not more than half the light provided should be used at one time. A background should be placed at each end of the room, and at whichever end the sitter is placed, the blinds should be opened on that side only; the darkened portion of the room will be pleasant for the sitter to look into, and useful to place the camera in. When the sitter is taken at the other end, everything must be reversed. As the majority of portraits are best taken with three-quarter face, and as a pleasanter expression and definition of the eyes are secured when they are allowed to look away from the light, these desirable conditions are entirely secured by this arrangement of light. The side of the room should be papered or painted of a rather light colour, but not white, and the reflection from this will, in nearly all cases, be sufficient to prevent dark shadows on the least illuminated side of the face. A moveable screen reflector, made of light calico, may be used according to circumstances, to modify the dark shades. Every variety of lighting, from the Rembrandt to almost flat effect, can be easily obtained in such a room by varying the position of the sitter and the camera. By having a background at each end of the room, either side of the face may be taken equally well, and this is a point by no means to be undervalued by the portraitist, especially as most persons have one side of the face better than the other. In short, no glass-room is in any degree approaching a perfect one unless the sitter can be equally well taken in any position or view; the light should always be made to suit the sitter, and not the sitter's position determined because of the arrangement of the light.

A room built as here described will be much more healthy than the usual conservatory-like structures, which are

cold in winter, hot in summer, leaky in wet weather, and dirty all the year round. All rooms devoted to photography should be thoroughly ventilated, and the chief point in ventilation is to provide for the escape of the hot and vitiated air which rises to the top of the apartment. In the glass-room, therefore, the very ridge is the place. Doors and side windows are well enough for letting in cold air, for which, by-the-bye, there is no room till the hot air escapes; but the heated atmosphere crowds to the top of the room, eager to go out in that direction, but objecting to go in any other. Provide it with proper means to get out, and the colder and purer air will always find a way to take its place. A good glass-room should also be provided with means to heat it in wet and cold weather. If a hot-water system cannot be used, a good household grate, giving a cheerful fire, may be provided on the bricked-up side. Above all things, that deadly abomination, the ordinary gas stove, should be avoided. By attending to these minor points, the sitter will feel and look more pleasant during the ordeal, and the photographer himself will derive greater health and pleasure in following his business.

TRANSPARENCIES FOR DECORATING WINDOWS, AND FOR THE MAGIC LANTERN.

An interesting application of photography is the production of transparencies for window decorations, and for the magic lantern. They may be produced by the dry or the wet process. The first proceeding is to obtain a suitable negative. It should be clear, clean, and very sharp. The high lights should not be too opaque, but full of half-tone, and the shadows free from fog and full of detail. Although

there is no fixed size for the magic lantern, yet 3¼ inches square is a usual size, and for which the ordinary stereoscopic negative is well adapted; but every person will, of course, make the pictures the dimensions to suit either the lantern he uses, or the window he wishes to ornament. If the negative be the same size that the transparency is wished, the proceeding is very simple, as any of the dry processes may be employed. The negative has to be placed in the printing-frame, and the dry plate put in contact, as in ordinary printing. A few seconds' exposure in diffused light, varying with the intensity of the negative, will be enough; or gaslight may be used, when a few minutes will be necessary. The plates should be developed by the acid pyro, as that gives a better tone than alkaline pyro; pyrogallic and citric acid yield a bluish-black, and pyrogallic and acetic acid a brown-black tone. The picture, if intended for the magic lantern, should not be varnished, unless the blacks are foggy, but mounted by putting another glass the same size to protect the collodion film, and binding the edges like a passepartout. If intended to be suspended as a transparency, it should be varnished, and the collodion side protected with a *ground* glass. The edges may be secured with paper or cloth, to keep out the dust. Instead of a dry plate, an ordinary unmounted, albumenized paper print may be used, if it be printed much darker than usual. The effect is not so good as a glass plate, but it is more readily produced. The print may be soaked in spirit varnish to render it more transparent. Very perfect results may be produced by carbon printing. See "Autotype Printing," published at one shilling.

If, however, the negative from which the transparency is to be made is larger or smaller than the size required, the lens and camera must be employed, and the negative must

be copied *by transparency*. Many methods of doing this will suggest themselves to ingenious persons; one of these is by placing the negative in a window, all the rest of which is darkened, and copying the negative by the light that thus streams through it; the rest of the room must, of course, be in complete darkness.

Another plan is by the use of "a copying camera for transparencies." This instrument is a kind of double bellows-bodied camera; that is, another body is provided *before* the lens, in addition to the usual body behind it. This extra body is provided with sliding holders, to receive different sized negatives. The central screen carrying the lens can be freely moved backwards or forwards, so as to approach either the negative or the ground glass, so that either a reduced or an enlarged copy may be made. To use the camera, place the negative in its holder at one end and the usual ground glass in the other, screw the lens on to the central screen, and put it in its place. If the size is to be reduced, push the negative further from the lens, and put the ground glass nearer; if it is to be increased, reverse the plan, putting the negative nearer and the ground glass further from the lens. How much nearer or further the lens must be from the ground glass, or from the negative, depends on the focal length of the lens, and on the desired degree of enlargement or reduction.

The adjustment made, the camera may be inclined to the north sky; and the light streaming through the negative will form its image on the ground glass in the usual manner. A quarter-plate double combination lens, with central diaphragms, will be found convenient for this work. First focus with open aperture, then put in the smallest stop, and

proceed as if for producing an ordinary negative; but instead of a negative a transparent positive will be produced. Most usually the ordinary wet method will be found the easiest and simplest. Pyrogallic acid or iron may be used as a developer, the former by preference, as yielding a better tone and denser image. If the latter be used, and the tone be not approved, intensify, after fixing, with pyro 2 grains, citric acid 1 grain, water 1 ounce; or to produce blacker tones, wash the plate well from the hypo or cyanide fixing solutions, and pour on a weak solution of chloride of iridium until a rich black tone is produced.

HINTS AND MEMORANDA.

When working away from home, be sure to take everything with you, and never rely upon what you can get "there." It is provoking to find that you have brought everything with you except, perhaps, the dipper, the ground glass, or the dark slide.

Double or treble the exposure in the camera is required during an easterly wind.

Examine, and, if necessary, re-yellow, the window of the dark-room in the spring of the year. The chemical obstruction sufficient for winter is quite inadequate for the spring and summer.

Wash your plates well; wash your negatives well; wash your prints well; and wash yourself well.

To take quick pictures, practise cleanliness. Clean lenses, clean camera, clean windows, clean glasses, clean chemicals, clear air, and a clear head, are all necessary in working quickly.

Keep your apparatus all in good order. Do not put them away with anything defective. Nothing can be depended on if there is a screw loose anywhere.

Avoid the use of wide-angle lenses when the ordinary ones will do. They are dangerous tools to use.

Extremes of heat and cold are not good for the photographer or his chemicals. In the hot weather they are difficult to control, from their exuberant activity; in cold weather they are sluggish and torpid, and lose half their power. Moral: avoid extremes. Keep your camera, your chemicals, and yourself, cool in summer and warm in winter. Both you and they will work all the better with an equable temper and temperature.

Ventilation is the soul of health. Ventilate your dark-room; ventilate your bath, your camera, your tent, and your ideas.

Read, mark, learn, and inwardly digest the experience of others as exhibited in the Photographic Journals.

Don't be led away by every fresh idea you hear. Don't expect to succeed with every new process read of, but don't condemn it because it fails in your hands.

Don't believe every novelty to be an improvement; don't hastily credit every new discovery; make great allowance for the exaggeration and enthusiasm of inventors, but keep your mind open and unprejudiced to receive every new truth, from whatever quarter it may proceed, or in whatever guise may appear.

PART III.

GENERAL REMARKS ON THE VARIOUS DRY PROCESSES.

The instruction previously given refers to the use of the collodion plate in its wet state. Various means have been devised to use the plates dry, so that, being prepared before starting, they may be exposed during a journey away from home, and developed and finished on the return. This method of using sensitive plates naturally increases the usefulness of photography, but the knowledge how to prepare a wet plate is not alone sufficient to prepare a dry one. If the usual wet sensitive plate be allowed to dry, without taking any precautions, it will be found to be quite useless for taking a photographic picture upon. It has to pass through another process, more or less complex, to enable it to be so used. It will be unnecessary here to detail all the methods that have been devised to so prepare the plate. It will be sufficient to describe a few of the most perfect plans.

Nearly all the dry plate processes are the same in their general principles; they start by coating a plate with ordinary bromo-iodized collodion, and sensitizing it in a nitrate of silver bath; their differences consist in the various methods employed to preserve the sensitiveness that the plate has attained.

ON PREPARING DRY COLLODION PLATES.

The preparation of the wet plate being already described, it is only necessary to say that the preliminary manipulations for preparing a dry one, unless where described otherwise, are exactly the same. The point of divergence commences when the plate has been fully sensitized in the nitrate bath. Instead of putting it in the dark slide, and immediately exposing in the camera, the plate is submitted to sundry operations, and then it is allowed to dry. These latter operations distinguish the various "dry processes."*

The collodion film, as already remarked, when once dried, changes its character; and, when re-wetted, never returns to the previous porous, pappy condition; it becomes skinny and horny, and does not adhere well to the glass. Many persons use a preliminary coating of albumen—about one ounce of white of egg in twenty ounces of distilled water—upon the plate, to prevent the film slipping off when re-wetted, and during development; others are content simply to varnish the sensitive film a quarter of an inch all round before re-wetting the plate.

An excellent suggestion by Mr. Bartholomew is, to pour dilute alcohol over the plate prior to developing; this seems to restore, to some extent, the porous condition. When the alcohol has well soaked in, the plate has to be washed and the developer applied; all the subsequent operations will be made better through this preliminary wash of alcohol,

* These remarks apply to processes where bromo-iodized collodion and the nitrate bath are used, but the Bromide Emulsion processes are quite distinct, and will be specially alluded to.

the plate behaving more like an ordinary wet one, and the film adhering better to the glass.

It will be seen, in glancing over different processes, that though the final end, a sensitive dry plate, is the thing aimed at in all, the means adopted to secure it are very varied. In nearly every case a something is incorporated with the sensitive film which is not present, or even needed, when the plate is used wet. The number of these preservative substances is endless, and the mode of employment constitutes the different dry processes. No end of aqueous solutions of animal and vegetable substances have been used with different degrees of success. Albumen is deservedly a great favourite. Gelatine has been applied in more than one form, and sugar in many—to wit, honey, grape sugar, brown and white sugar, candy, and caramel; many syrups, especially raspberry; different gums; solutions of malt, beer, and ale; various wines, British and foreign; liquors and spirits; milk, tea, coffee, starch, dextrine, and kindred substances; in fact, there scarcely seems a limit to materials capable of being used for the purpose, so that the question is quickly obtruded, which is the best? To this there is no definite answer, for good pictures have been taken by every process. For absolute certainty, the collodio-albumen, in its primitive form, is recommended; for simplicity, the bromide emulsion; and for rapidity, plates prepared by the gelatine process.

In all processes where the ordinary bromo-iodized collodion is used, it will be better to add two grains per ounce of bromide of cadmium to the collodion, and to allow the plates a much longer immersion in the nitrate bath than in the wet process. This is more especially necessary when the "alka-

line development" is employed. When such an addition of bromide of cadmium is made, the nitrate bath should be increased in strength to between forty to fifty grains of nitrate of silver, and the solution should be made decidedly acid with nitric acid.

THE "WASHED-PLATE" PROCESS.

This is the plainest process, and may be considered the basis of all; it consists in preparing and sensitizing the plate as for the wet method, then washing it well in distilled water, to get rid of all the superficial nitrate of silver solution. The plate is then to be carefully dried in the dark. Prior to development the plate must have the edges varnished, if the plate has not previously been albumenized, and be re-immersed in the nitrate bath, and the development conducted just the same as for a wet plate, the ordinary developing solution being used.

DRY PLATES WITH A "PRESERVATIVE."

The "washed plate" will answer if prepared on one day and used the next, and if the collodion is of the description called "organic;" but if the collodion is not of this nature a weak and worthless image is produced. Many persons have successfully surmounted this difficulty by adding one grain per ounce of common resin to their collodion. The chief reason why the simply washed plate will not "keep" is, that the atmospheric action appears to decompose the sensitive surface. This is obviated by the additional operation of pouring over the plate a solution of some organic substance, which serves the purpose of a varnish, protecting

the film from the atmosphere; it also supplies the organic material to form, on development, a strong and vigorous image. This preservative coating also renders the film less skinny, and permits the developing solution more readily to penetrate it. Hence most persons prefer to take the extra trouble of applying a preservative, and the particular preservative substance used gives the name to the process.

Instead, therefore, of attempting to give the various dry methods, it may be sufficient to state that if, upon the well-washed wet plate, a weak solution of any of the substances that are named on page 101 be poured and allowed to dry uniformly in the dark, a "dry plate" is produced.

A ten-grain solution of tannin makes a good preservative. A two-grain solution of pyrogallic acid, poured over the plate and simply dried, or a saturated solution of gallic acid, are also found to be satisfactory. If the surface of the plate turn brown on the application of any of these solutions it is evidence that the silver has not been sufficiently washed away, and more washing will therefore be necessary. Strong solutions of ordinary coffee and black tea have also answered well; and immersing the washed plate in bitter ale, and in stout, have also produced good plates. Albumen is a substance that has always been a great favourite, and has been used in various ways, the most important being the Collodio-Albumen process, which is described on page 109. The sensitiveness of the plate will somewhat depend upon the preservative, but chiefly upon the mode of development. If acid pyro be used, the plate may be from five to twelve times less sensitive than the same plate used in its original wet state; and if alkaline pyro be used, it will be pro-

bably from two to six times less sensitive. There is considerable margin, however, and the golden rule with a dry plate is never to under-expose.

HOW TO DEVELOP DRY PLATES.

There is usually only one way to develop a wet plate; there are several ways of developing a dry one. Instead of repeating these, in detailing the dry processes, it is better to give them here fully in detail, as the same general principles apply to all the methods of developing dry plates.

In no branch of photography has so much progress been recently made as in development, especially since sensitive films have been used exclusively of bromide of silver. It is now fully established that a latent image formed on iodide of silver is best developed by the acid method; and that the latent image on bromide of silver can be brought out best by the alkaline one. In developing an image in the ordinary wet process by acidified protosulphate of iron, the latent image is brought out by the precipitation upon it of metallic silver from the nitrate of silver solution that is always present. Unless the silver be there as free silver, there is no material for the iodide to appropriate to itself to build up the image, for the sensitive film of iodide of silver is not decomposed during the action of development. Hence nitrate of silver solution forms the most important part of the developer, and must always be present when an iodide film is being developed; for though the iodide film contains silver itself, yet it will not yield it up by spontaneous decomposition, but abstracts it from the solution of the nitrate that surrounds it. It is quite different when the bromide of silver is developed by the alkaline method. The image in this

case is also formed of silver, but *the silver is supplied by the decomposition of the film itself.* Hence no external supply of silver is necessary to form the image on the bromide film. And, if there be sufficient of the bromide of silver in the film, not only can the image be brought out, but, by continuing the action, sufficient intensity can be obtained to make it quite dense enough for printing, without obtaining silver from any external source. If, however, the amount of bromide of silver is not considerable in the film, the necessary density for printing purposes cannot be so obtained, and recourse must be had to an acid silver solution to increase still further the silver deposit to make a strong negative. It will therefore be seen that in those dry processes where but little bromide is used, the alkaline method can only be employed for the operation of developing, and that acid silver is afterwards required to communicate the necessary density to the weak image.

If these interesting facts are understood they materially simplify the production of dry plates, especially so far as the development is concerned. The more bromide there is in the film, the more fitted is the plate for alkaline development; and as bromide of silver with alkaline development is more sensitive to light than iodide of silver with acid silver development, the increased fitness for the use of the bromide is made manifest. For this reason additional bromide of cadmium is recommended to be added to the usual bromo-iodized collodion, as the plates, while equally fitted for acid development, are better adapted for the alkaline, which latter method permits a shorter exposure. It must not be forgotten, however, that the increase of the bromide in the collodion will require a longer immersion in

the bath while sensitizing, in consequence both of the greater amount of silver salt to be formed, and the relatively slower formation of the bromide than the iodide of silver.

Acid Pyro Developer.—This developer is formed as follows :—

Pyrogallic acid	1 grain
Glacial acetic acid	30 minims
Water	1 ounce

The plate, after being wetted with dilute alcohol and washed, has this solution flowed over it, to which has been added two or three drops of a 10-grain nitrate of silver solution. From what has previously been said it will be seen why this developer is adapted for a film entirely or chiefly formed of iodide of silver. *Acid* pyro will not develop an image unless nitrate of silver in solution is also present. A very small portion of silver, however, is sufficient to develop the primary image, though a larger quantity is required to intensify it. It is, therefore, recommended to add but a few drops of a weak solution of silver to the acid pyro in the first instance, so that only a weak image, complete in all its details, should be first formed. When the whole image is fully out, then additional silver is to be added for intensifying. If a strong silver solution were used in the first place, the most strongly-lighted parts would be intensified before the weaker details were fully developed, and an inferior result would occur.

Plain Pyro Developer.—When pyro is used without any addition, its strength may vary from one to five grains to the ounce of water; two grains may be taken as a medium. The dry plate being flooded with alcohol and water, and

washed, so as to well wet the film, the pyro solution is floated over, and in a few minutes—but not so quickly as a wet plate—the image appears. The image produced is a very weak and thin one. When all the details are fully out, then a few drops of an acid silver solution must be added to it to communicate intensity.

Alkaline Pyro Developer.—Make up these solutions in quantity, as they will not spoil in stoppered bottles.

No. 1.—Pyrogallic acid	... ...	96 grains
Absolute alcohol	... ...	1 ounce
No. 2.—Carbonate of ammonia	...	96 grains
Water	...	1 ounce
No. 3.—Bromide of potassium...	...	10 grains
Water	...	1 ounce

At the time of using, make up the following solution :—

Water	... ...	1 ounce
Solution No. 1	... ...	10 minims
Solution No. 3	... ...	5 ,,

Pour this over the wetted plate; allow it to remain on a few seconds only, and then pour back into the developing cup, and add to it five minims of solution No. 2, and apply again. The development will now commence, and if it be necessary, five minims more of No. 2 may be added, if the details indicate under-exposure. In this developing process the chief agent, of course, is the pyrogallic, and its power is materially stimulated by the alkaline carbonate. When these two are used alone there is sometimes a tendency to produce fog before the development is complete. The addition of the bromide corrects this. The bromide requires

caution in its use, as its effect is not only to check reduction and retard development, but, if used too freely, to prevent development altogether. Therefore as little of it should be used as possible. The exact quantity must be determined by the judgment of the worker. So that there be enough present to prevent fog, that is sufficient, no matter how little that may be. It may in some cases be omitted altogether. If the quantity named be not sufficient to arrest fog, more must be added, the behaviour of the plate during development being, after all, the best test. The details being well out, pour off the developer, and wash the plate; if the plate has been prepared with bromo-iodized collodion, the developed image, though perfect in all its details, will be too weak and thin for printing purposes; it will therefore be necessary to increase the intensity with the acid pyro and silver solution.

If, however, the plate is exclusively a bromide one, and a dense film exists, the development may be continued by the cautious addition of No. 2, until the full density is obtained. When there is an inclination to fog by pushing the development, or if there appear a difficulty in obtaining intensity, recourse may always be had to acid silver and pyro. This additional density may be given before or after fixing, or even after the plate has become dry. It will be necessary, however, to float some dilute acid—any acid will do—over the film to neutralize the ammonia before commencing to use the acid pyro and silver intensifier.

One of the most remarkable differences between the acid and alkaline methods of development consists in the greater latitude that is permitted in the exposure when the alkaline plan is used. Two plates may be exposed, the one the

right time, and the other very much over-exposed, and each may, by management of the developing, yield equally good negatives. No such range exists in the acid method. For example, if the image start out directly the developer is on it, over-exposure is implied. The solution should then be immediately poured off, and the plate well washed; the development should be commenced anew with a fresh solution, to which should be added twice or three times the usual amount of bromide, which latter will act as a restrainer. In like manner, by reducing, or even omitting, the bromide in the first instance, and by afterwards increasing the amount of the carbonate of ammonia, the developing action of the pyro will be stimulated in a short exposure. In the hands of an experienced manipulator this great power of adapting the developer to the exposure, as shown by the behaviour of the plate when the image first appears, materially reduces the most valid objection to dry plate work—the inability of judging at the moment whether the correct exposure has been given.

Whatever method of development be adopted, dry plates are fixed best with hyposulphite of soda, about five ounces to the pint of water.

THE COLLODIO-ALBUMEN PROCESS.

This process is not only the oldest, but also the most reliable of the dry processes. It is in reality a double process, in which sensitized collodion and albumen each play an important part in the production of the negative ; by its means Mr. Mudd, of Manchester, and others, have produced some of the most lovely photographs that have ever been taken.

The collodion employed is the ordinary bromo-iodized;

it should be of the kind that adheres tenaciously to the glass. Pour it on as usual, and let it set well before immersing in the nitrate bath. A pneumatic holder should be used, so that the plate may be covered at all the corners. Next sensitize it in the usual silver bath.

When the plate is sensitized, wash it well first with distilled, then with common water, and place it in a dish half filled with solution of iodide of potassium, three grains to the ounce, and allow it to remain while the next plate is being prepared. Then remove it from this solution, and wash it well with clean water, and pour over its surface the following solution of iodized albumen :—

Distilled water	2½ ounces
White of eggs	10 ,,
Iodide of potassium	50 grains
Bromide of ammonium	10 ,,
Liquor ammoniæ (fortis) ...	120 minims.

Place these materials, together with some pieces of broken glass, in a bottle capable of holding twice the quantity, and agitate till the whole forms a froth, and then, when settled, it is ready. Any other method of beating up the albumen will do, and this one is mentioned as being simple and effective. If a piece of camphor is always kept in this solution it will keep a considerable time, but must be filtered before using.

Allow the solution to flow backwards and forwards, to well saturate the film; repeat this operation with a second portion, and then set the plate aside to drain on blotting-paper. When the moisture is principally removed, finish the drying before a fire, or by other convenient means.

In this process, all the above operations may be performed in ordinary white light, as the plate, in this condition, is insensitive to light, and, provided it be kept dry, will remain good for any time.

To render it sensitive, heat it as hot as the hand will bear, and, when cool, immerse it again in the following aceto-nitrate of silver bath for one minute, *using only a yellow light*, then wash thoroughly in clean water, and dry in the dark.

Nitrate of silver	30 grains
Distilled water	1 ounce
Glacial acetic acid	½ drachm

These sensitive plates will keep good for a few weeks in warm weather, or even months in cold, if the last washing has been perfect; yet it is better to use them as soon as convenient after their second sensitizing. They are *sure* rather than *quick*, and may require about six times as long exposure as ordinary wet collodion.

The development may be commenced by either plain or alkaline pyro; Mr. Mudd gives the preference to plain pyro, and intensifying after with acid silver.

DR. RYLEY'S MODIFIED COLLODIO-ALBUMEN PROCESS.

The plate has to be sensitized as usual, and thoroughly well washed. When the plate has been well drained, and while still wet, coat it with the following solution of albumen:—

Albumen	1 ounce
Water	2 ounces
Ammonia	30 minims

Beat this solution well up to a froth, allow it to settle, and filter before use. Pour sufficient over the plate to cover it; let it flow backwards and forwards to soak into the film. Pour the albuminous solution away, and thoroughly wash the plate, the last rinsing being with distilled water. Let the plate dry. When perfectly dry, moisten the plate with distilled water, and pour over the following solution :—

Gallic acid	2 grains
Water	1 ounce

Filter the solution before using. Pour it on and off the plate to well permeate the film, then set the plate up to drain, and dry without washing off the gallic acid solution. When surface dry, finish by the heat of a dull fire.

These plates retain their sensitiveness well. Mr. Morley, of Islington, once showed me a negative that had been sensitized six months before exposure, and it was as perfect as plates newly-prepared. The development of the plates may be by the plain or alkaline pyro method, and intensified by acid pyro and silver.

The peculiarity of this process consists in the final wash of gallic acid *after the prepared plate has dried from its albuminous coating.*

An interesting experiment was tried by Mr. Morley to test the utility of this final wash of gallic acid. On one occasion, having some plates prepared without the gallic acid, but which, on examination prior to exposure, looked very unsatisfactory, having stains and markings of an annoying character very plainly evident, he determined to test the usefulness of the gallic acid. Upon a particular plate he poured, but on one half only, a solution of gallic acid.

The plate was dried, exposed, and developed as usual, and on the half without gallic acid the image was poor, weak, and dirty; while the other side was brilliant, clean, stainless, and all that was to be desired.

COLLODIO-BROMIDE PROCESSES.

In the ordinary processes the collodion contains an iodide and a bromide salt, and the bromide is usually regarded only as an auxiliary or assistant to the iodide. In the processes now to be described bromide of silver alone is used, and the alkaline development exclusively employed. A bromide of silver plate may be formed in two ways—by sensitizing bromized collodion in a bath of nitrate of silver, as in the usual process, and also by making an emulsion of collodion holding the bromide of silver in suspension, and pouring the sensitive material on the plate. Both these methods will be described.

BROMIDE OF SILVER WET PROCESS.

To ordinary good plain collodion add 8 grains per ounce of bromide of cadmium. The nitrate bath must be made 80 grains to the ounce, and slightly acidulated with nitric acid. The plate must remain in the bath the full time it requires to form a dense, opaque film. Bromide of silver forms slower than iodide of silver, and requires a much stronger bath. When the plate is ready (and it must not be removed from the bath until the film is much denser than in the ordinary wet process), it must be washed thoroughly to remove all silver. It must then have poured over it a three-grain solution of gelatine made slightly alkaline with carbonate of soda, or diluted albumen (albumen one ounce,

water four ounces, well beaten together). When the plate is in this condition it may be exposed wet, when it is declared to be three times more sensitive than the ordinary bromo-iodized wet plate. Or it may be allowed to dry, and it will be a good keeping dry plate, and is said to be as sensitive as the ordinary wet plate. Prior to development the plates must be well washed, and the alkaline method must always be adopted. If these plates are used dry, a preliminary coating of dilute albumen is necessary, but if used wet it may be dispensed with.

BROMIDE OF SILVER EMULSION PROCESS.

The neatest and most elegant form by which negatives may be taken is by the use of Sensitive Emulsion. The nitrate bath is entirely dispensed with, as the sensitive material is contained in the collodion. In former editions of this manual directions were given how to prepare it, but as this material is now supplied in commerce, the purchase of it ready made is recommended, especially as the preparation involves considerable technical skill and the use of a pyroxyline not usually attainable. The Emulsion supplied by the firm known as the "Liverpool Dry Plate Company" is of excellent quality. With this material it is only necessary to pour the collodion on to the plate, and allow it to dry, and the plate is ready for use. The development is by the alkaline method. Sensitive plates already prepared with this material may also be obtained from the same firm. The sensitiveness of these plates is quite equal to the usual dry plates. As ample directions accompany the emulsion and the plates, it is unnecessary to further describe them.

All the foregoing dry plate processes are old and well tried,

and many of them have their champions and followers, but, being slow, they do not keep pace with this age of progress and velocity. A few years ago the idea of dry plates being quicker than wet was laughed at and scouted as an absurdity; now, ten times quicker than wet is not considered sufficient, and some dry plate manufacturers are advertising their plates as twenty and thirty times quicker than wet collodion; this is running to the other extreme, and in a dangerous direction, for a large majority of failures in working the gelatine dry plates that are only ten times quicker is due to over-exposure. What, then, must be the risks and difficulties in exposing and manipulating those enormously rapid plates? Photography is, however, one of those art-sciences in which there is no finality, and in which rapid and radical changes occur when they are least expected; so our wisest course is to accept what appears to be inevitable, and prepare for the coming REVOLUTION, by making ourselves acquainted with the new conditions of practice, and endeavouring to acquire a knowledge of the surest way to success.

RAPID GELATINE PLATES.

FOR negative purposes the gelatine process is fast superseding all others, and rapidly revolutionizing the practice of photography. It is, therefore, necessary to know how gelatine plates are made, and how they behave in the camera and developing-room. Numerous methods of making the gelatino-bromide emulsion have already been published, but as they are only modifications of Mr. Kennett's formula, it will be but justice to that gentleman to give his process *intact*, for to him most certainly is due the credit of having made the

gelatine process practically and commercially successful. To make the emulsion Mr. Kennett proceeds as follows :—

"Forty grains of Nelson's photographic gelatine are soaked in water till thoroughly swelled, and then drained. Thirty grains of potassium bromide are next dissolved in eight drachms of water, and poured on the swollen gelatine. The jar containing it is next placed in a can of hot water till the gelatine dissolves, and a perfect mixture is obtained. Forty grains of nitrate of silver are next dissolved in eight drachms of water, and poured into the gelatine mixture little by little, stirring with a glass rod the whole time. The emulsion is next poured into a flat dish, and allowed to set thoroughly, and is then cut up into little lumps or squares, with a piece of clean glass, and covered with water, and allowed to stand for an hour, when the water is changed, and the washing continued for four or five hours. The wash water is tested for free bromide of potassium by taking a portion of it in a test tube, and adding a drop of silver nitrate. The washing must be continued until a drop of nitrate of silver solution ceases to cause milkiness. After thoroughly draining, the gelatine is again dissolved by placing the vessel containing it in a jar of hot water, and the whole amount is, after adding one drachm of alcohol, made up to two ounces of solution." When the emulsion is in this condition the glass plates, previously cleaned with a little tripoli, or putty powder, and a pellet of cotton, are warmed, and coated with the mixture, and placed on a level shelf to set and dry. Mr. Kennett recommends the following method :—"When the solution is completed take a second bottle, and filter through a piece of muslin the contents of the first into it; this at once gets rid of all bubbles occasioned by the shaking up; you have now

a fine creamy emulsion ready for use. Apply it in the following manner:—Take a clean plate, warm it, and place it on a pneumatic holder; pour on the centre sufficient to cover the same, and with a thin glass rod guide the emulsion over the surface; tilt the plate to get an even film, and pour from off one corner any surplus quantity into the bottle, and place the plate flat on a levelled table or shelf until dry, which it will do, at a temperature of from 60° to 70° Fahr., in about three hours." Convenient drying boxes are now provided for the latter part of these operations. Some manipulators prefer bromide of ammonium, and others recommend slightly different proportions and more elegant modes of washing, such as dializing; but very excellent results have been obtained on plates prepared by the foregoing method, and it is as simple and reliable as any. All the operations must, of course, be performed in a suitably lighted chamber, and the light must be very much more non-actinic than is necessary for wet plate manipulations. Although the method of making gelatino-bromide plates is here given, it is scarcely worth any one's while making them, for there are so many really good plates made and sold by eminent manufacturers.

ON EXPOSING GELATINE PLATES.

The very slowest of gelatino-bromide plates being so much more sensitive than wet collodion plates, and more susceptible to the effects of weak rays and extraneous light, too much care or attention cannot be devoted to the working condition of the camera, dark slides, and lens, so as to avoid fog or flatness, which may easily be caused by the slightest light-leak in any part of the apparatus. As soon as it is

determined to employ these extra rapid plates, and before any attempts at exposure are made, the whole of the cameras and dark slides should be carefully examined, particularly the hinged slides and backs and the jacket of the lens, to see that not the faintest ray of extraneous light can possibly enter the camera. The focussing cloth should also be seen to, and placed carefully over the back of the camera, when the slide is drawn up; even in the studio this should not be neglected, and for outdoor exposure it is a condition that is absolutely imperative. Many good plates have been spoiled and condemned through inattention to this necessity.

Over-exposure should also be carefully avoided, especially at the commencement of operations, with these highly sensitive plates. It is best to give the shortest exposure possible at first, as it is much easier to see and calculate the amount of under-exposure, than to estimate how much less is required from the appearance of too much exposure. If under-exposure be attended to at the beginning, one or two experiments will enable the gelatine plate novice to judge of and arrive at the right exposure, whereas *many* plates are frequently spoiled, without arriving at the proper time, by beginning with and continuing to give too much time. Indeed, ninety per cent. of early failures may be safely attributed to over-exposure. Therefore, the shortest and cheapest way to obtain the correct time of exposure is to give the least time possible, and work upwards.

ON DEVELOPING GELATINE PLATES.

This part of the gelatine process, though extremely simple, requires the utmost care and attention, especially to the condition of the "dark room" and choice of working light. If

these two things are not carefully attended to, all sorts of annoyances and unsatisfactory results will arise. The faintest ray of *white* light must not be allowed to enter the room, either through the window sides, top or bottom of the door, or chinks in the walls, ceiling, or floor; yet there may be abundance of light to work by, if it is only of the right quality. This can only be determined by experience and testing, not only at the commencement, but from time to time, for all coloured glasses, paper, cotton, and silk fabrics change by the action of light. Even the spectroscope is not a sufficiently reliable test for highly sensitive conditions. Fog or no fog on the plates to be manipulated is the only safe test in photography. What did for the quickest wet plate will certainly not do for the most sensitive dry plate process, and it is folly to attempt to work the latter under the most satisfactory conditions of the former. A safe way is to begin with one sheet of good orange pot metal and one sheet of moderately dark ruby flashed, and if the colour is distressing to some weak eyes, it may be modified by the addition of an extra piece of lightish green. The light or window may be as large as convenient, the larger the better and more comfortable to work in; the only imperative condition is to have it of the right colour and quality. That is for filtered daylight; but the very best working conditions are secured by employing artificial light, either gas, paraffin oil, or candle light. If any one of these lights is employed, one thickness of ruby or good orange glass is sufficient; and, to avoid heating the room, or risk of shedding any white light on the plates, the artificial light should be placed *outside* the "dark room." This may be done in various simple and inexpensive ways, and still retain the power of admitting white light

when required. One great advantage derived from the use of artificial light is its constancy. By the employment of an unvarying light the eye is more readily trained, or educated, and seldom, or never, deceived as to density, when examining the negative either by reflected or transmitted light. If the use of filtered daylight were boldly ignored, numerous advantages would be the reward, especially in a climate like ours, where the light is so very variable. Having secured the proper conditions of a good working light, the process of development may be commenced with the utmost confidence, either with alkaline pyrogallic, or with oxalate of iron. Both are simple and certain, but each gives different or special results. The pyro developer yields yellowish and thin-looking negatives of a very non-actinic tint, while the oxalate developer yields rich bluish-black negatives or transparencies, resembling the appearance of a good wet plate by transmitted light. All or any bromide of silver plates can be developed in the oxalate of iron solution, and it is the cleanest and simplest process imaginable. To obtain good results by this process, it is only necessary to take the exposed plate out of the dark slide, lay it face uppermost in a clean glass, porcelain, or ebonite dish, and pour the clear solution on, and leave it standing for two or three minutes; by that time the whole of the picture will be distinctly visible, and the requisite density is generally obtained by leaving the plate in the developing solution until all the shadows of the picture, except the very blackest, have entirely disappeared; but on no account should the blackest or densest shadows of the picture lose their opal appearance on the surface of the negative. If that should occur, it may be unquestionably attributed to one of two things—over-exposure or diffused white

light—or it may be due to a combination of both these evils. The oxalate solution can be obtained all ready for use, and of a good keeping quality, or it can be made as occasion requires in the following manner:—Dissolve six ounces of neutral oxalate of potash in one pint of boiling water, and when the potash is all dissolved, add one ounce of oxalate of iron. The iron dissolves quickly, and as soon as the solution is cool and settled it is ready for use. Decant, and employ the clear solution only. When the development is complete, the solution may be poured back into the stock bottle, and used over and over again, until it is quite exhausted. The action of the oxalate solution becomes slower by use and age, and when it is in this state the negative requires longer immersion to obtain the requisite density. An old solution, or a dilute fresh one, should be employed when the plates are over-exposed. The best results, however, are always obtained when the proper amount of exposure has been given, and the oxalate bath in good working order.

The oxalate and iron solutions may be kept separately, and the ferrous oxalate made as required for immediate use by mixing the following proportions.

Solution No. 1.—Dissolve six ounces of neutral oxalate of potash in one pint of boiling water. Allow it to cool, and then bottle it for use as required.

Solution No. 2.—Dissolve two ounces of protosulphate of iron in five ounces of water. Allow it to cool, and then bottle for use.

To develop. Take six fluid drachms of solution No. 1, and two fluid drachms of solution No. 2. Pour the given or requisite quantity of No. 1 into a clean glass measure, then add the proportion of No. 2. The ferrous oxalate solution

is formed immediately, and should be employed at once. When the picture is developed, the solution should be thrown away, for the ferrous oxalate obtained in this manner will not keep, and should not be employed a second time. The stock solutions will keep when separate. Any quantity of ferrous oxalate solution can be obtained by mixing the above solutions in the proportions of three parts of the oxalate and one part of the iron solutions. Should the shadows be clouded, add a drop or two of hydrochloric acid, but do not add any acid unless the oxalate solution is alkaline. Cloudy shadows are caused by an alkaline condition of the ferrous oxalate solution, but an acid condition causes harshness, and renders the developer sluggish.

For alkaline pyro development the following is Mr. Kennett's, and very excellent pictures can be obtained thereby; but I strongly recommend every one to employ the pyro developer given by each maker of commercial dry plates. It is but fair to them to suppose that they have tried various proportions to obtain the best effects on their own plates, and that they have given the proportions according to their own experience, and which are probably the results of many experiments. I have tried nearly every commercial dry plate that has come into the market, and have rung the changes on every form of developer, but I generally find that the most satisfactory results are obtained by following the directions and employing the proportions given by the makers of the plates. I have only met with one solitary exception to this safe and reasonable rule.

KENNETT'S PYRO DEVELOPER.

No. 1.—To 4 grains of pyrogallic acid, add 1 oz. of water.

No. 2.—To ½ an oz. of strong ammonia, add 8 ozs. of water.

No. 3.—To 3 drams of bromide of potassium, add 8 ozs. of water.

Mix 2 and 3 in one bottle; they keep better together than separately.

In cold weather, a little less bromide or a little more ammonia may be used with advantage.

After exposure put the plate into a dish of water for five minutes or longer, and commence the development by adding to one ounce of No. 1, one half-dram each of Nos. 2 and 3, and pour on the plate; in a few seconds the image will appear; continue the development until sufficient density is obtained; or if any difficulty occurs in getting sufficient density, wash off, and don't be afraid of using the water; and intensify with the following:—Pyrogallic acid three grains, water one ounce, with eight drops of glacial acetic acid, to which add one or two drops of a 20-grain solution of silver; density to any amount will now be readily obtained. On no account let either the developer or intensifier remain on the plate after it has become discoloured, or a stained film will be the result. Should either the developer or intensifier quickly discolour, add a little more bromide to the first, and a little more acid to the last.

FIXING.

This can only be done with hyposulphite of soda, and a good working proportion is about four ounces to one pint of water; in some cases the quantity may be advantageously increased to six ounces, for some plates are not chemically fixed when they are visibly so, and it is always imperative that the plates should be chemically fixed, most especially if after-intensification has to be resorted to, or yellow hazy stains will appear, which are very prejudicial to the quality of the negative. After the negative is developed it should be washed immediately to free it from any further action of the developer, placed in the hypo bath, and allowed to remain a *few minutes after* the creamy appearance has all disappeared from the back of the plate. Should it then be discovered that after-intensification must be performed, it is a safe precaution to immerse the negative, after washing, in a bath of *fresh* hypo for two or three minutes, wash the plate again, and then immerse it in a saturated solution of common alum for about five minutes. This will harden the film, and remove all risks of blistering or frilling, and enable the plate to endure all the ablutions it must necessarily undergo in the process of re-intensification. After the operation of fixing, the plates should be placed in a dish or other vessel, and treated to three or four changes of water in the course of an hour, then finally well washed under the tap, and set in a rack to drain and dry spontaneously. No heat should be applied to hasten the drying under any circumstances; a good current of air is an excellent dryer, or the process of evaporation may be accelerated by dipping the plates in a bath of methylated alcohol, before placing them in the drying rack.

The operation of fixing need not necessarily be conducted in the yellow light, as the plates may be safely exposed to gaslight or daylight immediately after washing off the developer. I put this to a satisfactory test a short time ago by exposing a Swan's gelatine plate to daylight for four consecutive days before fixing, and found that no injury was done to the picture. The time of fixing did not appear to be prolonged, nor was there any appearance of "veiling" or other defect.

ON INTENSIFYING GELATINE PLATES.

Given the correct amount of exposure and proper development, gelatine dry plates do not require either immediate or subsequent intensification; but, in the practice of dry plate photography, as well as wet, some circumstances are constantly arising to render re-development or after-intensification necessary. I think it advisable, however, in the manipulation of gelatine plates, to have a wholesome dread of free nitrate of silver, and do not recommend re-development as it is generally practised. Neither before nor after fixing would I either employ or recommend the use of free silver to intensify gelatine plates, for so many risks are run and so many negatives ruined thereby. From the compact nature of the film it appears to be impossible to deal with these plates as we have been accustomed to deal with wet collodion negatives, and we are driven to do and adopt things to which we formerly had a great and well-founded repugnance. The use of bichloride of mercury as an intensifier has long been out of court among wet-plate workers, but in dry plate, and particularly gelatine dry plates, its use is far less objectionable than the use of nitrate of silver. Therefore I give the preference

to bichloride of mercury, and the best way to use it is as follows:—After the plate has been well washed and *dried*, put it into a bath of bichloride solution—a cold saturated solution is strong enough—and allow it to remain until the image is whitened; the more density required the longer the plate must remain in the bath of bichloride. When sufficient of the mercury has been deposited the plate should be taken out, well washed under the tap, and then placed in another dish or bath containing dilute ammonia—one drachm of strong liquor ammonia to one ounce of water. This will blacken the mercurial deposit, and give the negative the appearance of a wet plate by transmitted light. The negative should be a little over-intensified, to allow for a slight loss of density which will ensue on varnishing. I have treated many and various negatives in the manner above described, and have not noticed either increase or diminution of density, after obtaining a number of prints.

ON VARNISHING GELATINE PLATES.

It has been stated that gelatine films do not require varnishing; but that is not my experience, and I have come to the conclusion that they require more careful varnishing than films of collodion. Many negatives have been completely ruined by printing proofs only before they were varnished. If there is the slightest damp in the atmosphere, the sensitized paper, or the pads, particles of silver are sure to be absorbed by the gelatine film, which will eventually develop into red spots, and grow larger and deeper in colour the longer the plate is exposed to the light while printing. Unfortunately, these insidious silver spots do not reveal them-

selves at first, or they might be easily removed with a little weak solution of cyanide of potassium. They have, unhappily, the treacherous habit of lying in the film dormant and invisible until after the plate is varnished, when it is too late to remove them successfully and certainly. If a gelatine plate should be printed for proof or otherwise, it should be washed, and treated to a bath of weak cyanide; well washed and dried again before it is varnished, so as to reduce the risk of those fatal silver stains appearing; but the only safe way is to varnish first and print afterwards. So much importance do I attach to gelatine plates being properly varnished. I treat them all in the following manner, and have no reason to suppose that they receive too much attention:—As soon as the film has dried spontaneously, I hold the plate over the flame of a spirit lamp, or before a fire, just long enough to expel any moisture that may be hanging about. I then coat it with a thick enamel collodion, and when that is set and perfectly dry, I varnish it with a good-bodied negative varnish in the usual way, and I have never found that negatives so treated have behaved in any eccentric manner, but have invariably conducted themselves as good and properly-behaved negatives should, yielding any required number of good and brilliant prints, and rewarding me amply for the pains and care I had bestowed on their production.

I must say, however, that my greatest successes have invariably been obtained by using the ferrous oxalate developer, and I most decidedly give a preference to that mode of development. Negatives so obtained print quicker than pyro-developed negatives, and do not appear to change either by much printing or long keeping, whereas pyro-developed nega-

tives sometimes grow denser and sometimes become fainter during the process of printing. The latter defect I have generally attributed to an excessive dose of ammonia, which produced a kind of false density, more from ammoniacal stains than a reduction of silver by the agency of pyrogallic acid; and as the ammonia was gradually liberated by the action of light, or other causes, such negatives gradually lost density and, in some instances, disappeared almost totally.

In conclusion, I beg most respectfully to impress upon every gelatine plate-worker that, from first to last, whether he makes his own plates, or employs those made by others, he should give his utmost and most intelligent attention to every stage of the manipulation of these marvellously rapid, reliable, and comfortable substitutes for all the annoyances, dirt, and discomforts attending the practice of wet collodion. If he does, he will find that there is a power in their rapidity, a comfort in their cleanliness, and a charm in their beauty, that never were dreamt of before in the philosophy of photography.

PIPER & CARTER, Printers, 5, Castle Street, Holborn, London, E.C.

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